

BS

SMALL TOOLS

· CATALOG ·

BS NO. 28 BS



IMPORTANT

List Prices in this catalog have been revised in accordance with the enclosed blue pamphlet. Prices on all High Speed Steel Screw Machine Tools and High Speed Steel Cutters have been temporarily withdrawn.

Dec. 13, 1920.

BROWN & SHARPE MFG. CO.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.

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SMALL TOOLS

CATALOG No. 28



BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I., U. S. A.

Established 1833

Also Manufacturers of

MILLING MACHINES

SCREW MACHINES

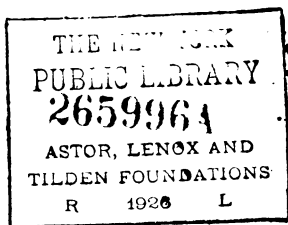
GRINDING MACHINES

GEAR CUTTING MACHINES

1920

Brown & Sharpe

BROWN & SHARPE MFG. CO.



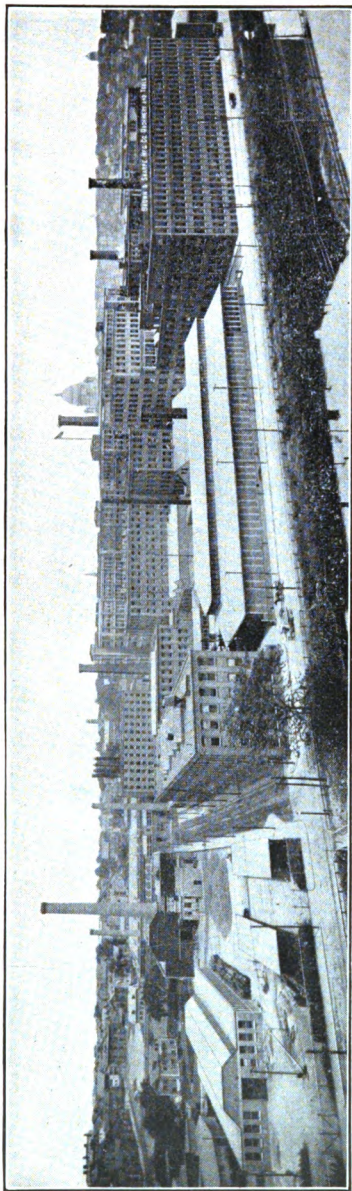
Important

WHEN ordering tools from this catalog, always give the full name and tool number as listed, and mention "Catalog No. 28."

This will lessen the chances of mistake and will often save time and correspondence.

Mention Catalog No. 28

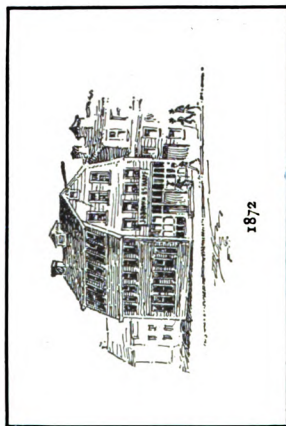
26X207



Main Office and Works of the Brown & Sharpe Mfg. Co., Providence, R. I.

LEADING AWARDS RECEIVED

London, 1862; Paris, 1867 and 1878; Vienna, 1873; Philadelphia, 1876; Chicago, 1893; Tennessee Centennial Exposition, 1897; Buffalo, 1901; Paris, Grand Prix, 1889 and 1900; Brussels, Grand Prix, 1897 and 1910; St. Louis, Grand Prize, 1904; Liège, Grand Prix, 1905; Milan, Grand Prix, 1906; Brussels, Grand Prix, 1910; Turin, Grand Prix, 1911



1872

Of Interest

THE business now conducted by the Brown & Sharpe Mfg. Co. was founded in 1833 by David Brown and his son Joseph R. Brown. David Brown retired in 1841, and the business was continued by Joseph R. Brown until 1853, when Lucian Sharpe became his partner, and the firm of J. R. Brown & Sharpe was formed. The Brown & Sharpe Mfg. Co. was incorporated in 1868.

The manufacture of Steel Rules and other tools of precision was begun by Joseph R. Brown in 1850, and in 1852 Samuel Darling began a similar line of work.

The partnership of Darling, Brown & Sharpe was formed in 1866, and the business carried on under that name until the partnership was dissolved by the purchase of Mr. Darling's interest.

The Buildings are modern and especially arranged to meet the requirements of the business. The machine shops are fire-proof. The business, therefore, is free from danger of serious interruption, and, on work entrusted to us, customers are given security against loss by fire.

Floor Area. The ten main manufacturing buildings have a floor space of about 900,000 sq. ft., and the foundry about 245,000 sq. ft., the forging, hardening, central power plant and miscellaneous buildings about 215,000 sq. ft. In 1853 the floor space occupied was 1800 sq. ft.; the present buildings have 1,360,000 sq. ft. of floor space, or over 31 acres.

Our Tools and Appliances are the best attainable. The tools described in this catalog are made with the intention that they shall be the best in their respective classes. Careful attention is constantly given to insure workmanship of the best quality.

Prices and Dimensions. The prices and dimensions are subject to change without notice.

Orders. We would request our customers to use the names or numbers of tools as printed in the catalog. This will enable

us to fill orders promptly and correctly. We are often at a loss to know what is wanted when other names or descriptions are employed.

We would impress upon purchasers the advantages of ordering, if possible, articles that are made in large quantities and carried in stock, in the place of goods that vary only slightly from them, but have to be made to-order.

Parties ordering small quantities of goods from us direct will please enclose either a Check on New York, a Post Office Money Order, or currency for the amount of goods wanted, which will be forwarded at once by express or as may be directed.

When goods are ordered to be sent by express, with bill to be collected on delivery, the express charge for collecting will be added. Small articles can be sent by mail when additional cost of postage is remitted. We are not responsible for losses in the mails.

In ordering special tools to be graduated and figured, our customers are particularly requested to send a clear description and a sketch showing the exact position of figures and graduations wanted.

All verbal orders and instructions should be confirmed in writing.

Please address all business communications to the Company.

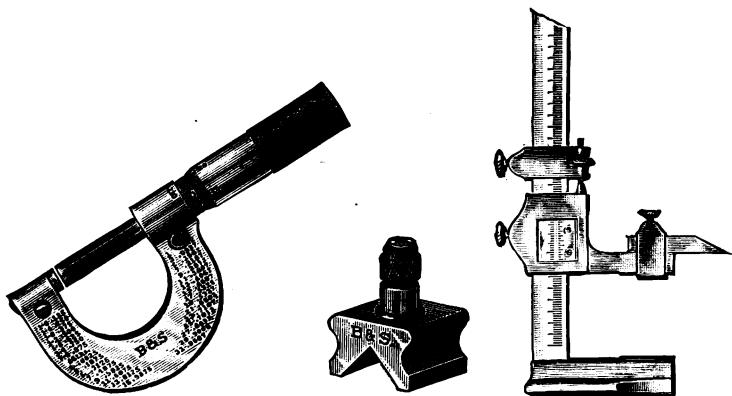
The tools described in this catalog are carried in stock. They are sold by instrument and hardware dealers throughout the country and may usually be obtained at once, thus saving delay and the cost of transportation.

In cases where these cannot be readily procured from dealers, we will send any of our Machinists' Tools on receipt of price to any place in the United States or Canada.

Should any defect become apparent in the workmanship of any of our tools, we request that we be promptly notified of the same.

We are always ready and pleased to show our works to those who are interested in machine-shop practice.

Electrotypes

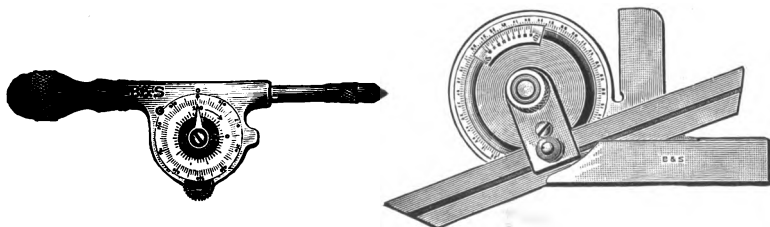


WE are always glad to provide electrotypes of our goods for use in making up catalogs, folders, newspaper advertising, and for like purposes on the request of any of our dealers. Cuts of our goods used in his advertising connects the local dealer with our extensive advertising in technical papers.

We carry a stock of electrotypes of all the tools, cutters and equipment shown in this catalog, and are ready to furnish them free of charge. These cuts are of the sizes shown in this catalog and our General Catalog of Machinery and Tools.

For Dealers' Catalogs and Newspapers. We also have a complete line of cuts of all tools, cutters, etc., shown in this catalog of a small size suitable for dealers' catalogs, newspaper advertising and similar purposes. These electrotypes are from good wood cuts and should give satisfactory results on all grades of paper. They measure 2 1-4" or under, the longer way.

We will furnish any of the three sizes mentioned above as desired, but these are the **only** sizes which we can provide. Only new electrotypes from these cuts are sent out.



Publications

We issue the following copyrighted publications

Practical Treatise on Milling and Milling Machines

Edition of 1919

This work is a thorough treatise on Milling and Milling Machines. 334 pages, 210 illustrations. Sent on receipt of price. Cloth, \$1.50. Cardboard, \$1.00.

Construction and Use of Automatic Screw Machines

Edition of 1918

This book is published to assist those who are not familiar with the construction and use of the Automatic Screw Machine. Sent on receipt of price. Cardboard, 50 cents.

Construction and Use of Universal Grinding Machines

Edition of 1918

This work describes the construction and use of Universal Grinding Machines, as made by us. Fully illustrated. Sent on receipt of price. Cardboard, 25 cents.

Construction and Use of Plain Grinding Machines

Edition of 1918

This work describes the construction and use of Plain Grinding Machines, as made by us. Fully illustrated. Sent on receipt of price. Cardboard, 25 cents.

Practical Treatise on Gearing

Edition of 1920

This book, with its tables and illustrations, is written for those in practical life who wish to obtain practical explanations and directions for making Gear Wheels. Sent on receipt of price. Cloth, \$1.25. Cardboard, 75 cents.

Formulas in Gearing

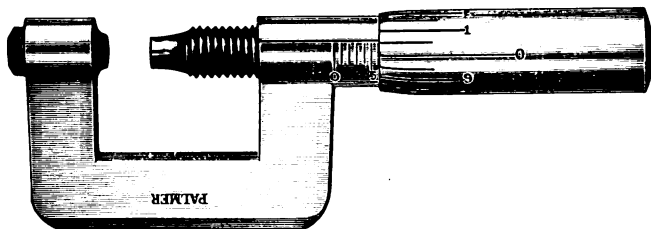
Edition of 1918

This work supplements the "Practical Treatise on Gearing," and contains formulas for solving the problems that occur in gearing. Sent on receipt of price. Cloth, \$1.50.

Handbook for Apprenticed Machinists

This book, illustrated, is for the Apprenticed Machinist. It is carefully written to assist the learner in the use of Machine and Machinists' Tools. Sent on receipt of price. Cloth, 75 cents.

The Micrometer Caliper



IT is always interesting to trace the development of an idea from the time it first assumes definite form to the time it becomes of practical value.

We must go back 72 years, and cross the ocean, to find the prototype of the micrometer of today in a French tool, known as the "Système Palmer," patented in France in 1848.

Messrs. J. R. Brown and Lucian Sharpe, during their visit to the Paris Exposition in 1867, saw this and were impressed with its latent possibilities.

Early in the same year, a concern in this country manufacturing brass had a shipment returned to them because it was "out of gauge." Investigation showed that of three U. S. Standard gauges then in use, no two of them agreed as to the gauge of the brass in question.

The brass manufacturer, conceiving the idea of a measuring tool, sent a sketch to J. R. Brown & Sharpe for experimental work. This tool had no commercial value as it was next to impossible to read with any accuracy.

On their return from Paris in 1867, Messrs. Brown & Sharpe introduced the "Pocket Sheet Metal Gauge," adopting the Palmer system of divisions, adding, however, means of compensating for wear of both the screw and measuring surfaces.

From this beginning, through acquired patents and ideas worked out in their own shops, Brown & Sharpe have developed the present micrometer.

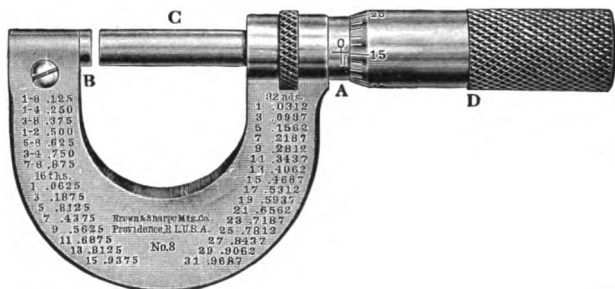
Many men have contributed to its development but practically all features can be traced back to the "Système Palmer" brought to America in 1867 by Joseph R. Brown and Lucian Sharpe.

The Principle of the Micrometer

OUR Micrometer Calipers are graduated to read to thousandths of an inch, but one-half and one-quarter thousandths are readily estimated. Some of the calipers have Verniers by which sizes can be obtained to ten-thousandths. We also furnish calipers to read to hundredths of a millimetre.

The chief mechanical principle embodied in the construction is that of a screw free to move in a fixed nut. An opening, to receive the work to be measured, is afforded by the backward movement of the screw, and the size of the opening is indicated by the graduations.

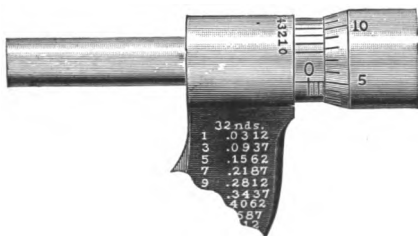
The pitch of the screw, C, is forty to the inch. The graduation of the hub, A, in a line parallel to the axis of the screw, is forty to the inch and is figured 0, 1, 2, etc., every fourth division, representing 0, .100", .200", etc. As the graduation conforms to the pitch of the screw, each division equals the longitudinal distance traversed by the screw in one complete rotation and shows that the caliper has been opened one-fortieth or .025 of an inch.



The beveled edge of the sleeve, D, is graduated into twenty-five parts and figured every fifth division, 0, 5, 10, 15, 20. Each division, when passing the line of graduations on the hub, indicates that the screw has made one twenty-fifth of a turn and the opening of the Caliper increased one twenty-fifth of one-fortieth, or one one-thousandth of an inch.

Hence, to read the Caliper, multiply the number of divisions visible on the scale of the hub by twenty-five and add the number of divisions on the scale of the sleeve from zero to the line coincident with the line of graduations on hub.

EXPLANATION AND METHOD OF READING THE CALIPERS WITH TEN-THOUSANDTHS GRADUATIONS



The readings in ten-thousandths of an inch are obtained by means of a Vernier or series of divisions on the hub of the Caliper, as shown in cut. These divisions are ten in number, occupy the same space as nine divisions on the sleeve, and for convenience in reading are figured 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

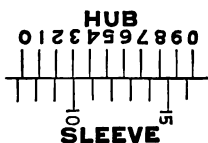
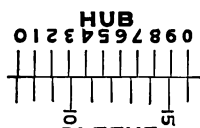
Accordingly, when a line on the sleeve coincides with the first line of the Vernier, the next two lines to the right differ from each other one-tenth of the length of a division on the sleeve; the next lines differ by two-tenths, etc. See upper cut of graduations on hub and sleeve.

When the Caliper is opened, the sleeve is turned to the left, and when a division passes a fixed point on the hub, it shows the Caliper has been opened one-thousandth of an inch. Hence, when the sleeve is turned so that a line on the sleeve coincides with the second line (end of the first division) of the Vernier, the sleeve has moved one-tenth of the length of one of its divisions, and the Caliper opened one-tenth of one-thousandth, or one ten-thousandth of an inch.

When a line on the sleeve coincides with the third line (end of second division) of the Vernier, the Caliper has been opened two ten-thousandths of an inch, etc. See lower cut of graduations, where a line on the sleeve coincides with the fourth line (end of third division of the Vernier) and the reading is three ten-thousandths of an inch.

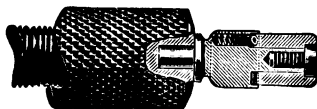
To Read the Caliper, note the thousandths as usual, then the number of divisions on the Vernier, commencing at 0, until a line is reached with which a line on the sleeve is coincident. If the second line, figured 1, add one ten-thousandth; if the third, figured 2, two ten-thousandths, etc.

Calipers graduated to ten-thousandths should not be used commonly where fine measurements are not required, as wear, which would be of comparatively slight consequence in a Caliper that reads only to thousandths, is perceptible and important in an instrument of this class.



Ratchet Stop

FOR MICROMETER CALIPERS



The Ratchet Stop can be furnished with any of our Micrometer Calipers. It is found convenient where a number of measurements have to be quickly taken, as it enables the objects measured to be subjected to the same degree of pressure.

In opening the tool, the pawl positively engages the ratchet so that it cannot slip by, thus making the Ratchet Stop positive in its return.

The ratchet and pawl are hardened.

Soft Leather Cases

FOR MICROMETER CALIPERS

Price, 40 Cents

We carry in stock Soft Leather Cases for Micrometer Calipers. These cases are convenient for those who wish to carry a Micrometer Caliper in the pocket. They are made to hold Micrometer Calipers of 1-2", 1", or 2" capacity. When ordering give size of Caliper with which it is to be used.

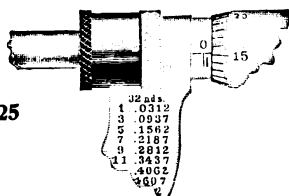
Spindle Protector No. 1

FOR MICROMETER CALIPERS

Patented August 11, 1914



Price, \$0.25



The Spindle Protector is an attachment which will fit any (except the Rex Micrometer) of our one inch Micrometers and also Micrometers Nos. 30 to 53 inclusive listed on the following pages.

It consists of a metal cap containing a felt washer which fits tightly over the spindle in the manner shown above. It protects the spindle bearing from dust, emery grit, etc., without interfering with the action of the spindle or the clamp ring.

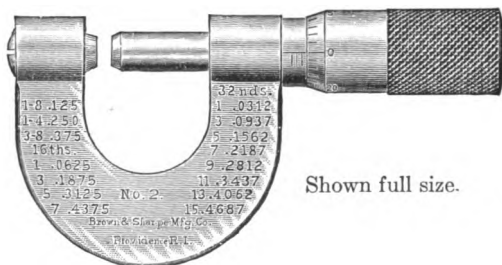
The capacity of the caliper is slightly lessened by the application of the Protector. When ordering, customer should give the diameter of the micrometer frame, as the Protector is made in three sizes, .460" to .462", .463" to .465", and .467" to .469".

Micrometer Caliper No. 2

ENGLISH OR METRIC MEASURE

Range, 0 to 1-2" or 0 to 13 m/m

Price, \$7.00 With Ratchet Stop, \$7.50 Morocco Case, \$1.00



Shown full size.

English Measure. Measures all sizes less than one-half inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than 13 millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

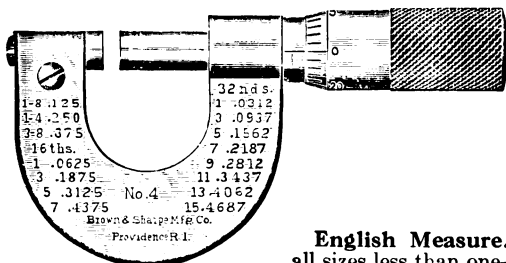
Each of the above packed one in a box.

Micrometer Caliper No. 4

ENGLISH OR METRIC MEASURE

Range, 0 to 1-2" or 0 to 13 m/m

Price, \$7.00 With Ratchet Stop, \$7.50 Morocco Case, \$1.00



English Measure. Measures all sizes less than one-half inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than thirteen millimetres by hundredths of a millimetre. When so made the table of decimal equivalents is omitted.

Micrometer Caliper No. 5

ENGLISH OR METRIC MEASURE

Range, 0 to 1-2" or 0 to 13 m/m

Price, \$8.00 With Ratchet Stop, \$8.50 Morocco Case, \$1.00

Differs from Micrometer Caliper No. 4 only in having a **Clamp Ring** which clamps the spindle and preserves the setting.

Micrometer Caliper No. 6

Range, 0 to 1-2"

Price, \$8.75 With Ratchet Stop, \$9.25 Morocco Case, \$1.00

Differs from Micrometer Caliper No. 4, English measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch.

Micrometer Caliper No. 7

Range, 0 to 1-2"

Price, \$9.75 With Ratchet Stop, \$10.25 Morocco Case, \$1.00

Differs from Micrometer Caliper No. 6 only in having a **Clamp Ring** which clamps the spindle and preserves the setting.

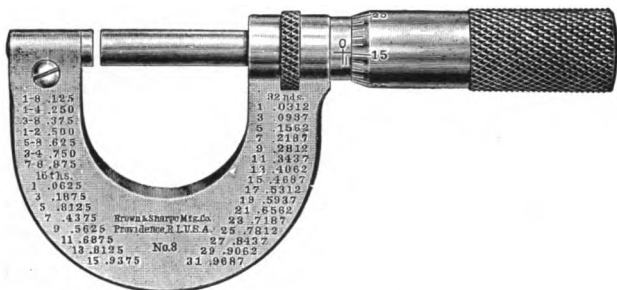
Each of the above packed one in a box.

Micrometer Caliper No. 8

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$9.50 With Ratchet Stop, \$10.00 Morocco Case, \$1.00



English Measure. Measures all sizes less than one inch by thousandths of an inch.

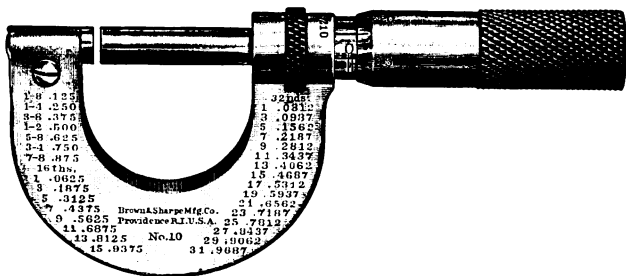
Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

A **Clamp Ring**, which clamps the spindle and preserves the setting, is provided.

Micrometer Caliper No. 10

Range, 0 to 1"

Price, \$11.25 With Ratchet Stop, \$11.75 Morocco Case, \$1.00



Differs from Micrometer Caliper No. 8, English measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch.

Each of the above packed one in a box.

Rex Micrometer Caliper

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 mm

Price, \$7.50 With Ratchet Stop, \$8.00 Morocco Case, \$1.00



The Rex is made to meet the demand for a comparatively inexpensive yet accurate measuring tool.

The frame is drop forged and of a type combining rigidity and strength with lightness and ease of handling.

The bearing parts and measuring surfaces are hardened, and means are provided to compensate for wear of measuring screw and anvil.

The recessed section of the frame is japanned, all other parts being highly polished.

The decimal equivalents of fractional parts of an inch are stamped along the sleeve.

English Measure. Measures all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made, the decimal equivalents are omitted.

Packed one in a box. Google

Micrometer Caliper No. 12

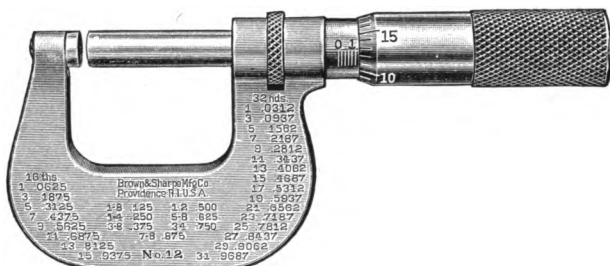
ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$9.50

With Ratchet Stop, \$10.00

Morocco Case, \$1.00



Comparatively new in design, this Caliper differs from the others in the type of frame, the end of which is tapered so that the thickness at the anvil is only 11-32", allowing the Caliper to be used in places where the usual style of micrometer will not enter.

English Measure. Measures all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made the table of decimal equivalents is omitted.

Rounded Anvil for Measuring Tubing. Regularly furnished with a square anvil, as illustrated, but can be furnished, without extra cost, when desired, with rounded anvil, similar to that of the Micrometer Caliper No. 225, for measuring tubing.

A Clamp Ring, which clamps the spindle and preserves the setting, is provided.

Micrometer Caliper No. 13

Range, 0 to 1"

Price, \$11.25

With Ratchet Stop, \$11.75

Morocco Case, \$1.00

Differs from Micrometer Caliper No. 12, English measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch.

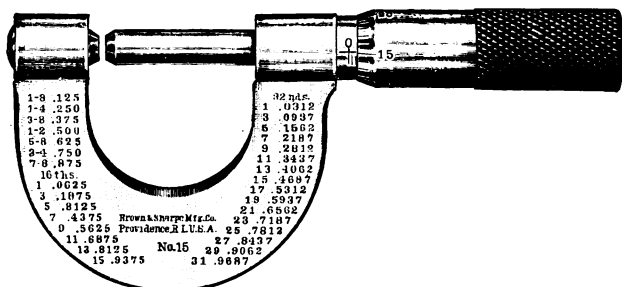
Each of the above packed one in a box.

Micrometer Caliper No. 15

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$8.50 With Ratchet Stop, \$9.00 Morocco Case, \$1.00



English Measure. Measures all sizes less than one inch by thousandths of an inch.

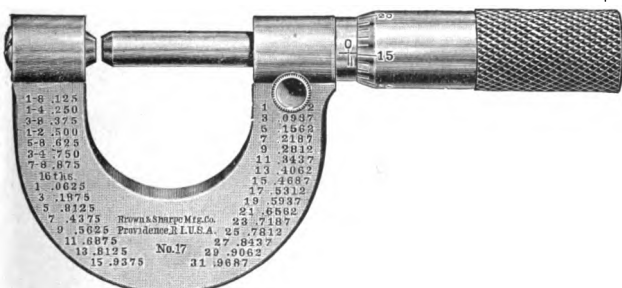
Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

Micrometer Caliper No. 17

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$9.50 With Ratchet Stop, \$10.00 Morocco Case, \$1.00



Differs from Micrometer Caliper No. 15 only in having a **Clamp Screw**, which clamps the spindle and preserves the setting.

Wooden Handle. This caliper is furnished, when desired, with a wooden handle attached at the bow of the frame. The handle is about 2 3-4" long and 1" largest diameter. When so fitted, the clamp screw is provided with wings instead of a knurled head.

Price of Wooden Handle, \$1.50 in addition to prices given above.

Each of the above packed one in a box.

Micrometer Caliper No. 19

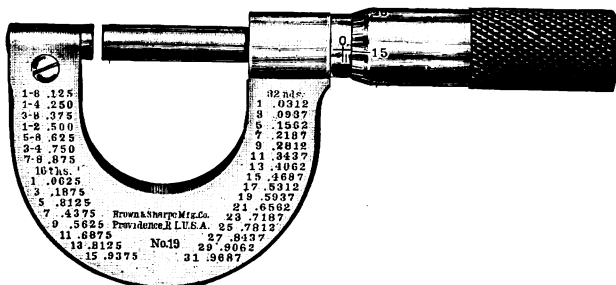
ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$8.50

With Ratchet Stop, \$9.00

Morocco Case, \$1.00



English Measure. Measures all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

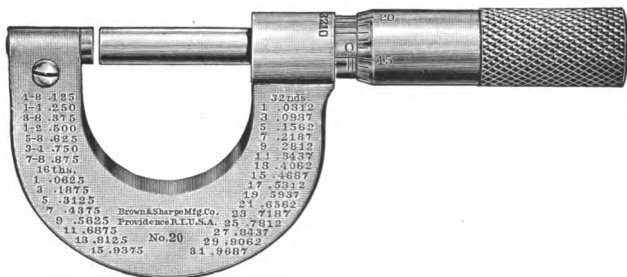
Micrometer Caliper No. 20

Range, 0 to 1"

Price, \$10.25

With Ratchet Stop, \$10.75

Morocco Case, \$1.00



Differs from Micrometer Caliper No. 19, English measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch.

Each of the above packed one in a box.

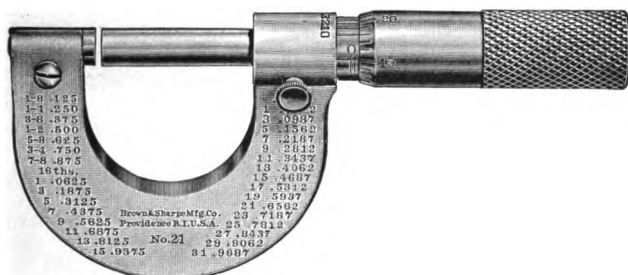
Micrometer Caliper No. 21

Range, 0 to 1"

Price, \$11.25

With Ratchet Stop, \$11.75

Morocco Case, \$1.00



Differs from Micrometer Caliper No. 20 only in having a **Clamp Screw**, which clamps the spindle and preserves the setting.

Micrometer Caliper No. 22

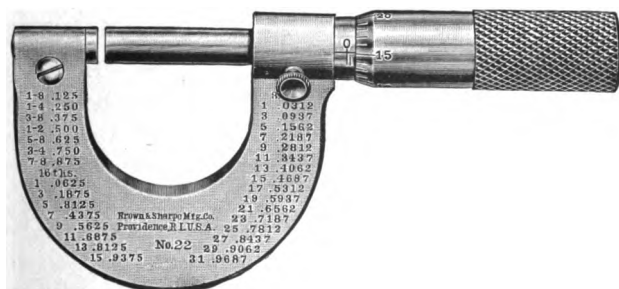
ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$9.50

With Ratchet Stop, \$10.00

Morocco Case, \$1.00

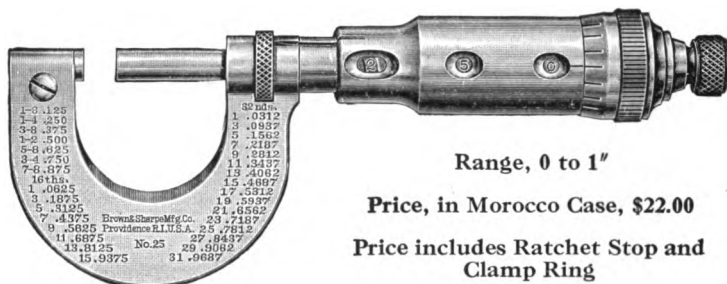


Differs from Micrometer Caliper No. 19 only in having a **Clamp Screw**, which clamps the spindle and preserves the setting.

Each of the above packed one in a box.

Direct Reading Micrometer Caliper No. 25

Patented Aug. 22, 1911; May 5, 1914



Range, 0 to 1"

Price, in Morocco Case, \$22.00

Price includes Ratchet Stop and
Clamp Ring

This Micrometer Caliper presents a very desirable feature in that thousandths of an inch can be read in exact figures, without the necessity of calculation with the aid of graduation lines. The mechanical principle of a screw free to move in a fixed nut, used in our regular line of Micrometer Calipers, and with which mechanics are familiar, is retained.

The figures showing in the opening nearest the frame indicate the movement of the spindle by tenths of an inch. Those in the next opening register the movement by hundredths of an inch, while the figures in the last opening indicate the movement by thousandths. In addition, the thimble on the end of the sleeve is graduated in connection with a line on the sleeve to read to thousandths of an inch. By means of these lines, fractional parts of a thousandth may be estimated.

The registering mechanism is so constructed that the dials are positively locked, and the micrometer cannot get out of adjustment and read incorrectly.

Parts not subject to wear or stress are made of an alloy to eliminate weight. All other parts are made of steel, the spindle and anvil being hardened. The caliper may be adjusted to compensate for wear the same as on our regular line of micrometer calipers.

Packed one in a box.

Micrometer Caliper No. 30

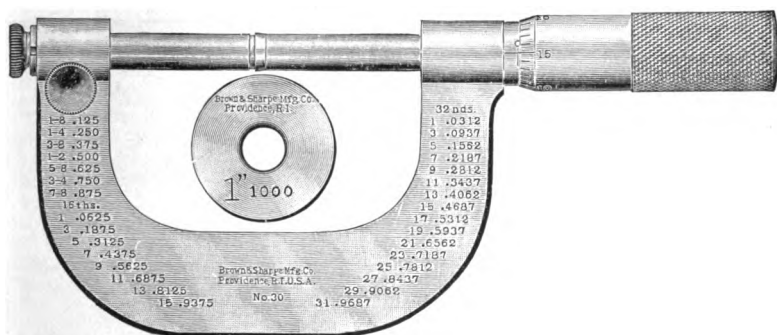
ENGLISH OR METRIC MEASURE

Range, 0 to 2" or 0 to 50 m/m

Price, \$12.50

With Ratchet Stop, \$13.00

Morocco Case, \$1.25



English Measure. Measures all sizes less than two inches by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than fifty millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

Micrometer Caliper No. 31

ENGLISH OR METRIC MEASURE

Range, 0 to 2" or 0 to 50 m/m

Price, \$13.50

With Ratchet Stop, \$14.00

Morocco Case, \$1.25

Differs from Micrometer Caliper No. 30 only in having a **Clamp Screw** which clamps the spindle and preserves the setting.

A Standard Gauge, to be used in adjusting the Caliper, is sent with each of the above.

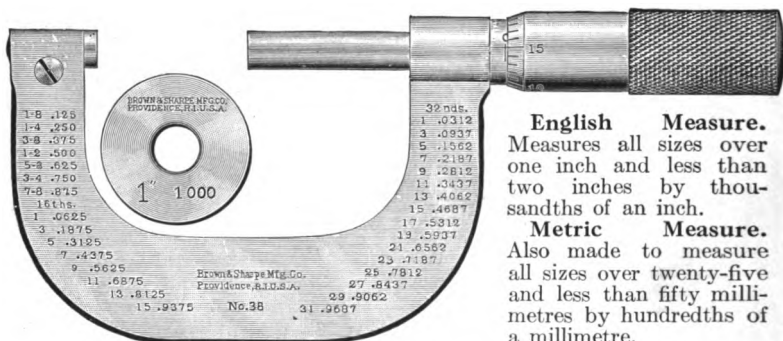
Each of the above packed one in a box.

Micrometer Caliper No. 38

ENGLISH OR METRIC MEASURE

Range, 1" to 2" or 25 m/m to 50 m/m

Price, \$9.50 With Ratchet Stop, \$10.00 Morocco Case, \$1.25



English Measure.
Measures all sizes over one inch and less than two inches by thousandths of an inch.

Metric Measure.
Also made to measure all sizes over twenty-five and less than fifty millimetres by hundredths of a millimetre.

When so made, the table of decimal equivalents is omitted.

Micrometer Caliper No. 39

ENGLISH OR METRIC MEASURE

Range, 1" to 2" or 25 m/m to 50 m/m

Price, \$10.50 With Ratchet Stop, \$11.00 Morocco Case, \$1.25

Differs from Micrometer Caliper No. 38, only in having a Clamp Screw which clamps the spindle and preserves the setting.

Micrometer Caliper No. 40

Range, 1" to 2"

Price, \$11.25 With Ratchet Stop, \$11.75 Morocco Case, \$1.25

Differs from Micrometer Caliper No. 38, English measure, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

Micrometer Caliper No. 41

Range, 1" to 2"

Price, \$12.25 With Ratchet Stop, \$12.75 Morocco Case, \$1.25

Differs from Micrometer Caliper No. 40, only in having a Clamp Screw which clamps the spindle and preserves the setting.

A Standard Gauge to be used in adjusting the Caliper is sent with each of the above.

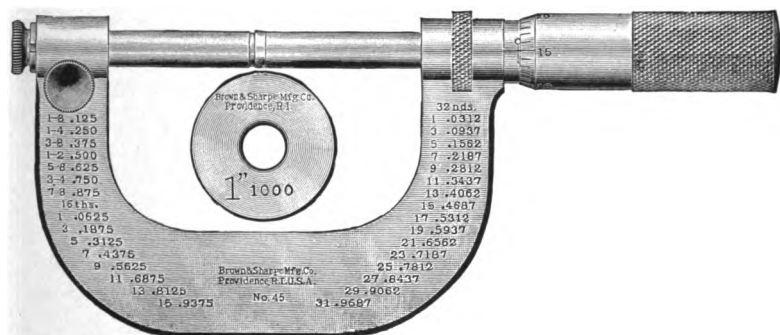
Each of the above packed one in a box.

Micrometer Caliper No. 45

ENGLISH OR METRIC MEASURE

Range, 0 to 2" or 0 to 50 m/m

Price, \$13.50 With Ratchet Stop, \$14.00 Morocco Case, \$1.25



English Measure. Measures all sizes less than two inches by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than fifty millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

A Clamp Ring, which clamps the spindle and preserves the setting, is provided.

A Standard Gauge, to be used in adjusting the Caliper, is sent with the above.

Packed one in a box.

Micrometer Caliper No. 47

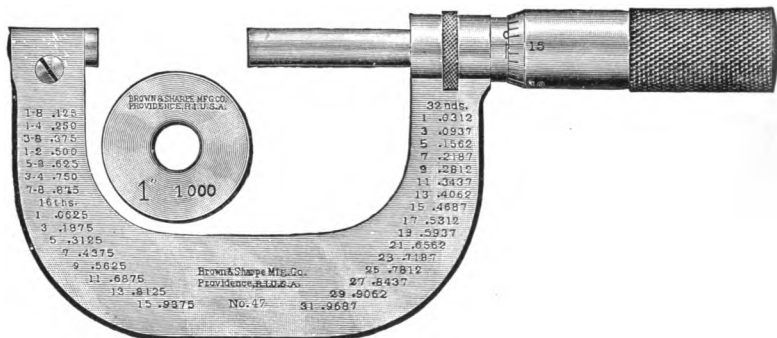
ENGLISH OR METRIC MEASURE

Range, 1" to 2" or 25 mm to 50 mm

Price, \$10.50

With Ratchet Stop, \$11.00

Morocco Case, \$1.25



English Measure. Measures all sizes over one inch and less than two inches by thousandths of an inch.

Metric Measure. Also made to measure all sizes over 25 and less than 50 millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

A Clamp Ring, which clamps the spindle and preserves the setting, is provided.

Micrometer Caliper No. 48

Range, 1" to 2"

Price, \$12.25

With Ratchet Stop, \$12.75

Morocco Case, \$1.25

Differs from Micrometer Caliper No. 47, English measure, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

A Standard Gauge, to be used in adjusting the Caliper, is sent with each of the above.

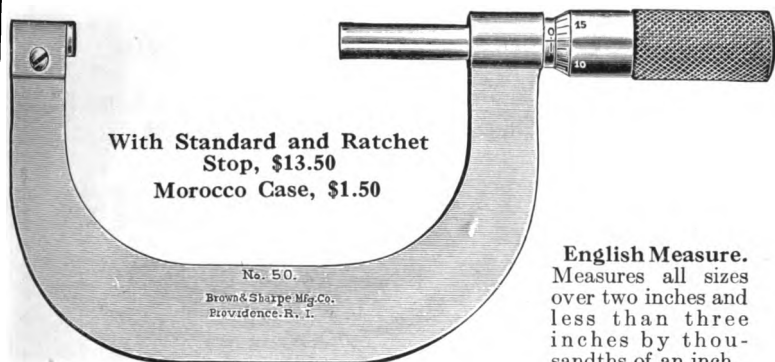
Each of the above packed one in a box.

Micrometer Caliper No. 50

ENGLISH OR METRIC MEASURE

Range, 2" to 3" or 50 m/m to 75 m/m

Price, \$11.50 With Standard, \$13.00 With Ratchet Stop, \$12.00



With Standard and Ratchet
Stop, \$13.50

Morocco Case, \$1.50

English Measure.
Measures all sizes
over two inches and
less than three
inches by thou-
sandths of an inch.

Metric Measure. Also made to measure all sizes over fifty and less than seventy-five millimetres by hundredths of a millimetre.

Micrometer Caliper No. 51

Price, \$13.25 With Standard, \$14.75 With Ratchet Stop, \$13.75
With Standard and Ratchet Stop, \$15.25 Morocco Case, \$1.50

Differs from Micrometer Caliper No. 50, English measure, only in reading to ten-thousandths as well as thousandths of an inch.

Micrometer Caliper No. 52

ENGLISH OR METRIC MEASURE

Range, 2" to 3" or 50 m/m to 75 m/m

Price, \$12.50 With Standard, \$14.00 With Ratchet Stop, \$13.00
With Standard and Ratchet Stop, \$14.50 Morocco Case, \$1.50

Differs from Micrometer Caliper No. 50 only in having a Clamp Ring which clamps the spindle and preserves the setting.

Micrometer Caliper No. 53

Price, \$14.25 With Standard, \$15.75 With Ratchet Stop, \$14.75
With Standard and Ratchet Stop, \$16.25 Morocco Case, \$1.50

Differs from Micrometer Caliper No. 52, English measure, only in reading to ten-thousandths as well as thousandths of an inch.

Furnished with Standards unless otherwise ordered

Each of the above packed one in a box.

50

51

52

53

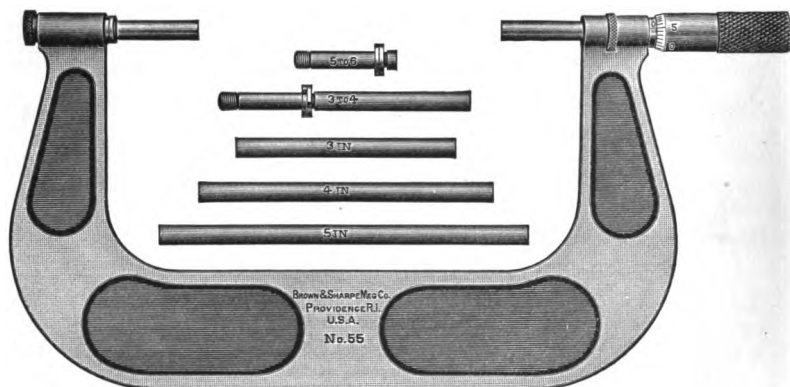
Micrometer Caliper No. 55

ENGLISH OR METRIC MEASURE

Range, 3" to 6" length, 6" dia.

or 75 m/m to 150 m/m length, 150 m/m dia.

Price, \$18.25 With Standards, \$24.50 With Ratchet Stop, \$18.75
With Standards and Ratchet Stop, \$25.00



English Measure. Measures all sizes from 3" to 6" by thousandths of an inch. Three anvils are furnished; the long anvil measures from 3" to 4", the intermediate from 4" to 5" and the short one from 5" to 6". Each anvil is provided with separate means of adjustment for wear. They are easily and quickly inserted in the frame and are held solidly to their bearings by a knurled nut.

Metric Measure. Also made to measure all sizes from 75 millimetres to 150 millimetres by hundredths of a millimetre.

A **Clamp Ring**, which clamps the spindle and preserves the setting, is provided.

Standards

A set of three Standards is furnished unless otherwise ordered.

Price, per set, \$6.25.

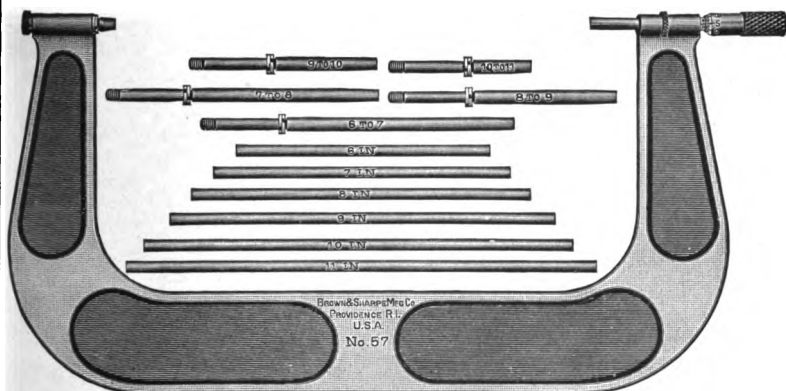
Packed one in a box.

Micrometer Caliper No. 57

ENGLISH OR METRIC MEASURE

Range, 6" to 12" length, 12" dia.
or 150 m/m to 300 m/m length, 300 m/m dia.

Price, \$37.50 With Standards, \$54.40 With Ratchet Stop, \$38.00
With Standards and Ratchet Stop, \$54.90



English Measure. Differs from Micrometer Caliper No. 55, English measure, only in that it measures all sizes from 6" to 12" by thousandths of an inch.

Six anvils are furnished and measure respectively 11" to 12", 10" to 11", 9" to 10", 8" to 9", 7" to 8" and 6" to 7".

Each anvil is provided with separate means of adjustment for wear.

Metric Measure. Also made to measure all sizes from 150 to 300 millimetres by hundredths of a millimetre.

A Clamp Ring, which clamps the spindle and preserves the setting, is provided.

Standards

A set of six Standards is furnished unless otherwise ordered.

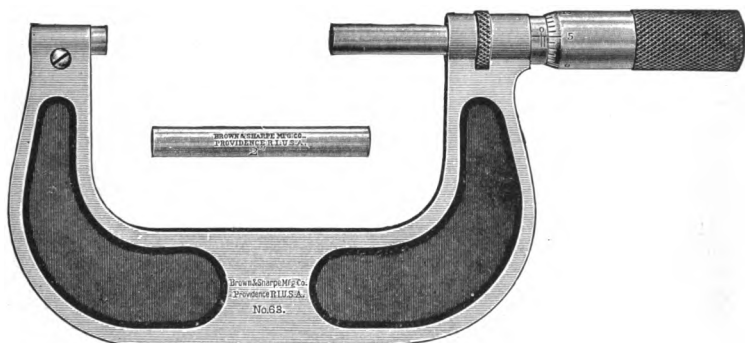
Price, per set, \$16.90.

Packed one in a box.

Micrometer Calipers

Nos. 61 to 88

ENGLISH OR METRIC MEASURE



The Micrometer Calipers listed on the opposite page are made to meet the demand for inexpensive, yet accurate measuring tools. They are more convenient for general use than the Bar Micrometer or Vernier, as they can be more readily set for the different measurements and are more easily handled where rapid measurements are required.

The frame is of I section, thus combining the greatest rigidity and strength with lightness.

English Measure. Measure within their capacity by thousandths of an inch.

Metric Measure. Also made to measure by hundredths of a millimetre.

A **Clamp Ring**, which clamps the spindle and preserves the setting, is provided.

Furnished with Standards unless otherwise ordered.

Packed one in a box.

Micrometer Calipers Nos. 61 to 88

(Continued)

ENGLISH OR METRIC MEASURE

No.	Range	Price without Standards	Price with Standards
61	1" to 2" or 25 m/m to 50 m/m	\$3.50	\$10.00
63	2 to 3 or 50 to 75	10.00	11.50
65	3 to 4 or 75 to 100	10.75	12.50
67	4 to 5 or 100 to 125	12.00	14.00
69	5 to 6 or 125 to 150	13.00	15.50
*71	6 to 7 or 150 to 175	14.50	17.00
72	7 to 8 or 175 to 200	16.00	18.60
73	8 to 9 or 200 to 225	17.50	20.20
74	9 to 10 or 225 to 250	19.00	21.90
75	10 to 11 or 250 to 275	20.50	23.50
76	11 to 12 or 275 to 300	22.00	25.20
77	12 to 13 or 300 to 325	24.25	27.55
78	13 to 14 or 325 to 350	26.50	30.00
79	14 to 15 or 350 to 375	29.50	33.10
80	15 to 16 or 375 to 400	32.50	36.30
81	16 to 17 or 400 to 425	35.50	39.40
82	17 to 18 or 425 to 450	38.50	42.60
83	18 to 19 or 450 to 475	41.50	45.70
84	19 to 20 or 475 to 500	46.00	50.40
85	20 to 21 or 500 to 525	51.25	55.75
86	21 to 22 or 525 to 550	55.75	60.45
87	22 to 23 or 550 to 575	61.75	66.55
88	23 to 24 or 575 to 600	67.75	72.75

For Ratchet Stop, add 50 cents to above prices.

Morocco Cases can be furnished as follows: Nos. 61, \$1.25; No. 63, \$1.50; No. 65, \$2.50; No. 67, \$2.75; No. 69, \$3.00 each.

Micrometers above 12" are of heavy construction and similar to our No. 100 shown on next page.

* Micrometers Nos. 71 to 88 are packed in finished cases, one to a case; the others are packed in wooden boxes similar to those of the smaller Micrometers.

Heavy Micrometer Calipers

Nos. 100, 102, 104, 106, 108 and 110

These Calipers are designed to meet the demands of constant and severe usage under adverse conditions, such as the dirt and moisture of grinding rooms or wherever it is desired to take frequent measurements with the clamp ring set.

They are made with a frame of heavy I section with a much heavier spindle and threaded portion than is usually put into calipers. This permits greater stiffness and insures longer life to the screw under adverse conditions because of larger bearing surface for the threads.

English Measure. Measure by thousandths of an inch.

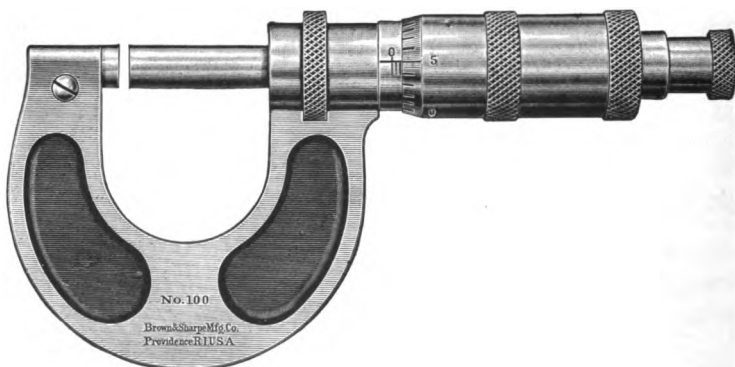
Metric Measure. Also made to measure by hundredths of a millimetre.

A **Clamp Ring**, which clamps the spindle and preserves the setting, and a **Ratchet Stop** are provided.

Heavy Micrometer Caliper No. 100

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 mm



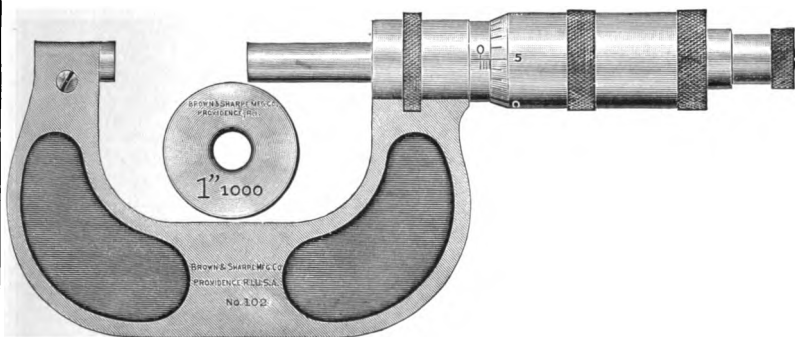
Price, \$12.00

Morocco Case, \$1.25

Packed one in a box.

Heavy Micrometer Calipers Nos. 102, 104, 106, 108 and 110

ENGLISH OR METRIC MEASURE



No. 102

Range 1" to 2" or 25 m/m to 50 m/m

Price, \$13.25 With Standard, \$14.75 Morocco Case, \$1.50

No. 104

Range 2" to 3" or 50 m/m to 75 m/m

Price, \$14.50 With Standard, \$16.00 Morocco Case, \$2.25

No. 106

Range 3" to 4" or 75 m/m to 100 m/m

Price, \$16.00 With Standard, \$17.75 Morocco Case, \$2.75

No. 108

Range 4" to 5" or 100 m/m to 125 m/m

Price, \$17.50 With Standard, \$19.50 Morocco Case, \$3.25

No. 110

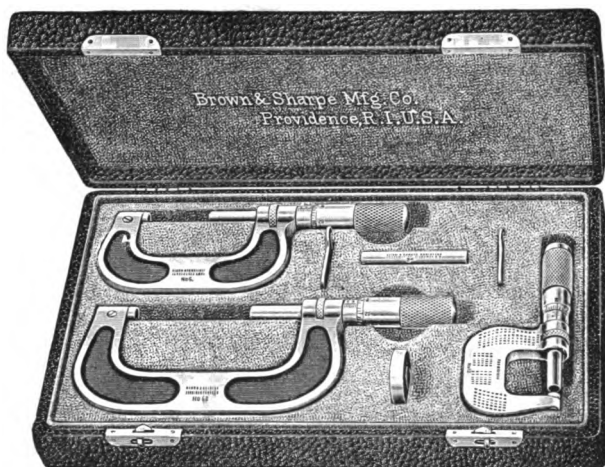
Range 5" to 6" or 125 m/m to 150 m/m

Price, \$19.00 With Standard, \$21.50 Morocco Case, \$3.75

Packed one in a box.

Micrometer Caliper Sets

133



Set No. 133

Set No. 133 shown above and listed on the opposite page, includes Calipers Nos. 12, 61, and 63 and forms a selection of particularly economical and reliable measuring tools. In this set, as well as in Sets Nos. 130 and 131, the Rex 1" Micrometer Caliper can be furnished in place of Micrometer Caliper No. 12 at the reductions in prices noted opposite.

The Micrometer Caliper Sets listed on the opposite page contain tools selected from our regular line with the view of making up inexpensive yet accurate and convenient sets of reference tools for inspecting the finished product as well as for general shop use.

English Measure. The Calipers in these sets, unless otherwise noted, measure by thousandths of an inch.

Metric Measure. Also made to measure by hundredths of a millimetre.

Furnished with Standards, in Case, and without Ratchet Stops unless otherwise ordered.

Packed one set in a box.

Micrometer Caliper Set No. 130

ENGLISH OR METRIC MEASURE

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m

Price, \$29.50 With Standards, \$31.00 With Ratchet Stops, \$31.00
With Standards and Ratchet Stops, \$32.50 Case, \$3.00 extra

Consists of Micrometer Calipers Nos. 19, 38, and 50, found on preceding pages. The Rex 1" Micrometer Caliper can be furnished in place of the No. 19 if desired, at a reduction of \$1.00 from the above prices.

Micrometer Caliper Set No. 131

ENGLISH OR METRIC MEASURE

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m

Price, \$32.50 With Standards, \$34.00 With Ratchet Stops, \$34.00
With Standards and Ratchet Stops, \$35.50 Case, \$3.00 extra

Differs from Micrometer Set No. 130 only in being provided with **Clamp Rings** which clamp the spindles and preserve the settings. It consists of Micrometer Calipers Nos. 8, 47, and 52, found on preceding pages. The Rex 1" Micrometer Caliper can be furnished in place of the No. 8 Caliper at a reduction of \$2.00 from the above prices.

Micrometer Caliper Set No. 132

ENGLISH MEASURE

3 Calipers, measuring from 0 to 3"

Price, \$37.75 With Standards, \$39.25 With Ratchet Stops, \$39.25
With Standards and Ratchet Stops, \$40.75 Case, \$3.00 extra

Differs from Micrometer Set No. 131, English measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch. It consists of Micrometer Calipers Nos. 10, 48, and 53, found on preceding pages.

Micrometer Caliper Set No. 133

ENGLISH OR METRIC MEASURE

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m

Price, \$28.00 With Standards, \$31.00 With Ratchet Stops, \$29.50
With Standards and Ratchet Stops, \$32.50 Case, \$3.00 extra

This Set is shown and described on the opposite page. The Rex 1" Micrometer Caliper can be furnished in place of the No. 12 Caliper at a reduction of \$2.00 from the above prices.

Micrometer Caliper Set No. 134

ENGLISH OR METRIC MEASURE

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m

Price, with Ratchet Stops, \$39.75

With Standards and Ratchet Stops, \$42.75 Case, \$3.00 extra

Made up of Heavy Micrometer Calipers Nos. 100, 102, and 104, found on preceding pages.

Packed one set in a box.

Micrometer Caliper Set No. 135

ENGLISH OR METRIC MEASURE

6 Calipers, measuring from 0 to 6", or 0 to 150 m/m

Price, \$63.75 With Standards, \$73.00 With Ratchet Stops, \$66.75

With Standards and Ratchet Stops, \$76.00 Case, \$6.00 extra

135



This set of Micrometer Calipers forms an inexpensive set of accurate and trustworthy reference tools for inspecting the finished product as well as for general shop use.

Consists of Micrometer Calipers Nos. 8, 61, 63, 65, 67 and 69 shown on preceding pages.

English Measure. Measures all sizes less than six inches by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than 150 millimetres by hundredths of a millimetre.

The Rex 1" Micrometer Caliper can be furnished in place of the 1" caliper shown, at a reduction of \$2.00 from the above prices.

The Case, furnished as an extra, is of substantial construction, lined with velvet and covered with leather.

Sent with Standards, in Case, and without Ratchet Stops unless otherwise ordered.

Packed one set in a box.

Micrometer Caliper Set No. 137

ENGLISH OR METRIC MEASURE

6 Calipers, measuring from 6" to 12" or 150 m/m to 300 m/m
Price, \$109.50 With Standards, \$126.40 With Ratchet Stops, \$112.50
With Standards and Ratchet Stops, \$129.40

Consists of Micrometer Calipers Nos. 71-76 inclusive, as listed on page 29.

137

Micrometer Caliper Set No. 138

ENGLISH OR METRIC MEASURE

11 Calipers, measuring from 1" to 12" or 25 m/m to 300 m/m
Price, \$163.75 With Standards, \$189.90 With Ratchet Stops, \$169.25
With Standards and Ratchet Stops, \$195.40

Consists of Micrometer Calipers Nos. 61-76 inclusive, as listed on page 29.

138

139

Micrometer Caliper Set No. 139

ENGLISH OR METRIC MEASURE

4 Calipers, measuring from 12" to 16" or 300 m/m to 400 m/m
Price, \$112.75 With Standards, \$126.95 With Ratchet Stops, \$114.75
With Standards and Ratchet Stops, \$128.95

Consists of Micrometer Calipers Nos. 77-80 inclusive, as listed on page 29.

140

141

Micrometer Caliper Set No. 140

ENGLISH OR METRIC MEASURE

4 Calipers, measuring from 16" to 20" or 400 m/m to 500 m/m
Price, \$161.50 With Standards, \$178.10 With Ratchet Stops, \$163.50
With Standards and Ratchet Stops, \$180.10

Consists of Micrometer Calipers Nos. 81-84 inclusive, as listed on page 29.

Micrometer Caliper Set No. 141

ENGLISH OR METRIC MEASURE

19 Calipers, measuring from 1" to 20" or 25 m/m to 500 m/m
Price, \$438.00 With Standards, \$494.95 With Ratchet Stops, \$447.50
With Standards and Ratchet Stops, \$504.45

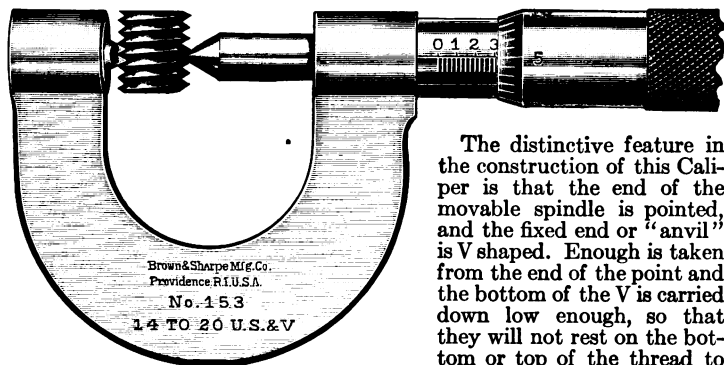
Consists of Micrometer Calipers Nos. 61-84 inclusive, as listed on page 29.

Standards are furnished with Sets unless otherwise ordered.

Packed one set in a substantial wooden case.

Screw Thread Micrometer Calipers

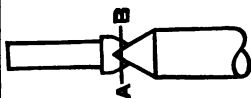
Nos. 150, 152, 153, 154, 155, 156, 157, 158 and 159



The distinctive feature in the construction of this Caliper is that the end of the movable spindle is pointed, and the fixed end or "anvil" is V shaped. Enough is taken from the end of the point and the bottom of the V is carried down low enough, so that they will not rest on the bottom or top of the thread to be measured, but on the cut

surface. As the thread itself is measured, it will be seen that the actual outside diameter of the piece does not enter into consideration.

As we measure one-half of the depth of the thread from the top, on each side, the diameter of the thread as indicated by the Caliper, or the pitch diameter, is the full size of the thread less the depth of one thread.



When the point and anvil are in contact, the 0 represents a line drawn through the plane A B, and if the Caliper is opened, say to .500, it represents the distance of the two planes .500" apart.

Special Screw Thread Micrometers can usually be furnished upon receipt of information regarding form of thread, range of pitches to be measured and outside diameter of work to be calipered. Prices on application.

No.	Capacity, Inches	Range		Form of Thread	Price
150	1-2	48	to 64 Thds. per in.	V or U. S. Standard	\$11.50
*152	1	8	to 13 Thds. per in.		12.00
153	1	14	to 20 Thds. per in.		12.00
154	1	22	to 30 Thds. per in.		12.00
155	1	32	to 40 Thds. per in.	V, United States or Whitworth Standard	12.00
156	2	4 1-2	to 7 Thds. per in.		14.50
*157	2	8	to 13 Thds. per in.		14.50
158	2	14	to 20 Thds. per in.		14.50
159	2	22	to 30 Thds. per in.		14.50

* Whitworth Standard range 8 to 12 threads per inch only.

Metric Measure. Also furnished in corresponding metric sizes for V, United States or Whitworth Standard thread.

Packed one in a box.

Table

For Use in Connection with Brown & Sharpe Mfg. Co.'s
Screw Thread Micrometer Caliper

READING OF CALIPER, OR PITCH DIAMETER

$$\text{For "V" Threads} = D - \frac{.866}{N}$$

"V" THREADS

Diam.	Threads per Inch	Caliper Reading or Pitch Diam.		Diam. *	Threads per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.866}{N}$	$\frac{.866}{N}$	D	N	$D - \frac{.866}{N}$	$\frac{.866}{N}$
	64		.0135	1-4"	24	.2139	.0361
	62		.0140	1-4	20	.2067	.0433
	60		.0144	5-16	20	.2692	.0433
	58		.0149	5-16	18	.2644	.0481
	56		.0155	3-8	18	.3269	.0481
	54		.0160	3-8	16	.3209	.0541
	52		.0167	7-16	16	.3834	.0541
	50		.0173	7-16	14	.3756	.0619
	48		.0180	1-2	14	.4381	.0619
	46		.0188	1-2	13	.4334	.0666
	44		.0197	1-2	12	.4278	.0722
	42		.0206	9-16	14	.5006	.0619
	40		.0217	9-16	12	.4903	.0722
	38		.0228	5-8	11	.5463	.0787
	36		.0241	5-8	10	.5384	.0866
	34		.0255	11-16	10	.6009	.0866
	32		.0271	3-4	10	.6634	.0866
	30		.0289	7-8	9	.7788	.0962
	28		.0309	1	8	.8918	.1082
	26		.0333	1 1-8	8	1.0168	.1082
				1 1-4	7	1.1263	.1237
				1 1-2	6	1.3557	.1443

As there is no standard of diameter for the finer pitches, the columns for diameter and caliper reading, or pitch diameter, are left blank. The column on the right gives the number to be subtracted from the diameter to obtain the caliper reading, or pitch diameter.

* These figures give the outside diameter for screws with threads cut theoretically sharp. As it is not practical to make these threads sharp, the outside diameter will measure less than the figures given, the pitch diameter remaining the same.

The pitch diameter for taps should be larger than for screws.

Table

For Use in Connection with Brown & Sharpe Mfg. Co.'s
Screw Thread Micrometer Caliper

READING OF CALIPER, OR PITCH DIAMETER

$$\text{For U. S. Threads} = D - \frac{.6495}{N}$$

U. S. STANDARD THREADS

Diam.	Threads per Inch	Caliper Reading or Pitch Diam.		Diam., Inches	Threads per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$		N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$
	64		.0101	1-4	20	.2175	.0325
	62		.0105	5-16	18	.2764	.0361
	60		.0108	3-8	16	.3344	.0406
	58		.0112	7-16	14	.3911	.0464
	56		.0116	1-2	13	.4501	.0499
	54		.0120	9-16	12	.5084	.0541
	52		.0125	5-8	11	.5660	.0590
	50		.0130	3-4	10	.6851	.0649
	48		.0135	7-8	9	.8029	.0721
	46		.0141	1	8	.9188	.0812
	44		.0148	1 1-8	7	1.0322	.0928
	42		.0155	1 1-4	7	1.1572	.0928
	40		.0162	1 3-8	6	1.2668	.1082
	38		.0171	1 1-2	6	1.3918	.1082
	36		.0180	1 5-8	5 1-2	1.5070	.1180
	34		.0191	1 3-4	5	1.6201	.1299
	32		.0203	1 7-8	5	1.7451	.1299
	30		.0217	2	4 1-2	1.8557	.1443
	28		.0232	2 1-2	4	2.3376	.1624
	26		.0250	3	3 1-2	2.8145	.1855
	24		.0271	3 1-2	3 1-4	3.3002	.1998
	22		.0295	4	3	3.7835	.2165

As there is no standard of diameter for the finer pitches, the columns for diameter and caliper reading, or pitch diameter, are left blank. The column on the right gives the number to be subtracted from the diameter to obtain the caliper reading, or pitch diameter.

Table

For Use in Connection with Brown & Sharpe Mfg. Co.'s
Screw Thread Micrometer Caliper

READING OF CALIPER, OR PITCH DIAMETER

$$\text{For Whitworth Threads} = D - \frac{.640}{N}$$

WHITWORTH STANDARD THREADS

Diam.	Threads per Inch	Caliper Reading or Pitch Diam.		Diam., Inches	Threads per Inch	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.640}{N}$	$\frac{.640}{N}$	D	N	$D - \frac{.640}{N}$	$\frac{.640}{N}$
	48		.0133	1-4	20	.2180	.0320
	46		.0139	5-16	18	.2769	.0355
	44		.0146	3-8	16	.3350	.0400
	42		.0152	7-16	14	.3918	.0457
	40		.0160	1-2	12	.4467	.0533
	38		.0168	9-16	12	.5092	.0533
	36		.0178	5-8	11	.5668	.0582
	34		.0188	11-16	11	.6293	.0582
	32		.0200	3-4	10	.6860	.0640
	30		.0213	13-16	10	.7485	.0640
	28		.0229	7-8	9	.8039	.0711
	26		.0246	15-16	9	.8664	.0711
	24		.0267	1	8	.9200	.0800
	22		.0291	1 1-8	7	1.0336	.0914
				1 1-4	7	1.1586	.0914
				1 3-8	6	1.2684	.1066
				1 1-2	6	1.3934	.1066
				1 5-8	5	1.4970	.1280
				1 3-4	5	1.6220	.1280
				1 7-8	4 1-2	1.7328	.1422
				2	4 1-2	1.8578	.1422
				2 1-8	4 1-2	1.9828	.1422

Tables

For Use in Connection with Brown & Sharpe Mfg. Co.'s
Screw Thread Micrometer Caliper

READING OF CALIPER, OR PITCH DIAMETER

$$\text{For A. S. M. E. Threads} = D - \frac{.6495}{N}$$

A. S. M. E. STANDARD THREADS

Same Form of Thread as the United States Standard

No.	Basic and Max. Outside Diam. D	Threads per Inch N	Caliper Reading or Maximum Pitch Diameter D — $\frac{.6495}{N}$	$\frac{.6495}{N}$	No.	Basic and Max. Outside Diam. D	Threads per Inch N	Caliper Reading or Maximum Pitch Diameter D — $\frac{.6495}{N}$	$\frac{.6495}{N}$
0	.060	80	.0519	.0081	12	.216	28	.1928	.0232
1	.073	72	.0640	.0090	14	.242	24	.2149	.0271
2	.086	64	.0759	.0101	16	.268	22	.2385	.0295
3	.099	56	.0874	.0116	18	.294	20	.2615	.0325
4	.112	48	.0985	.0135	20	.320	20	.2875	.0325
5	.125	44	.1102	.0148	22	.346	18	.3099	.0361
6	.138	40	.1218	.0162	24	.372	16	.3314	.0406
7	.151	36	.1330	.0180	26	.398	16	.3574	.0406
8	.164	36	.1460	.0180	28	.424	14	.3776	.0464
9	.177	32	.1567	.0203	30	.450	14	.4036	.0464
10	.190	30	.1684	.0217	..	...	..	....	....

READING OF CALIPER, OR PITCH DIAMETER

$$\text{For S. A. E. Threads} = D - \frac{.6495}{N}$$

S. A. E. STANDARD THREADS

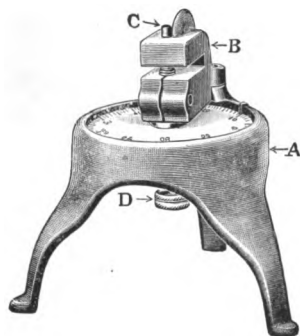
Same Form of Thread as the United States Standard

Diameter D Inches	Threads per Inch N	Caliper Reading or Pitch Diam. D — $\frac{.6495}{N}$	$\frac{.6495}{N}$	Diameter D Inches	Threads per Inch N	Caliper Reading or Pitch Diam. D — $\frac{.6495}{N}$	$\frac{.6495}{N}$
1-4	28	.2268	.0232	3-4	16	.7094	.0406
5-16	24	.2854	.0271	7-8	14	.8286	.0464
3-8	24	.3479	.0271	1	14	.9536	.0464
7-16	20	.4050	.0324	1 1-8	12	1.0709	.0541
1-2	20	.4675	.0324	1 1-4	12	1.1959	.0541
9-16	18	.5265	.0360	1 3-8	12	1.3209	.0541
5-8	18	.5890	.0360	1 1-2	12	1.4459	.0541
11-16	16	.6469	.0406	...	..	....	...

Sheet Metal Micrometer No. 220

Price, \$24.00

220



The tool shown above was one of the earliest forms of micrometer put upon the market. That it is still in demand proves its usefulness to certain classes of craftsmen. Jewelers, silversmiths, sheet metal rollers and workers, rubber and paper manufacturers, type founders, etc., find it especially convenient.

It measures to 1-4" by thousandths of an inch.

The frame A supports the measuring mechanism. The arm B holds the measuring screw D and the adjusting screw C. The knurled thumb screw D operates the measuring screw and the movable dial.

The movable dial is of German silver, and the graduations are read by means of the pointer shown at the right of arm B.

Provision is made for compensation for wear.

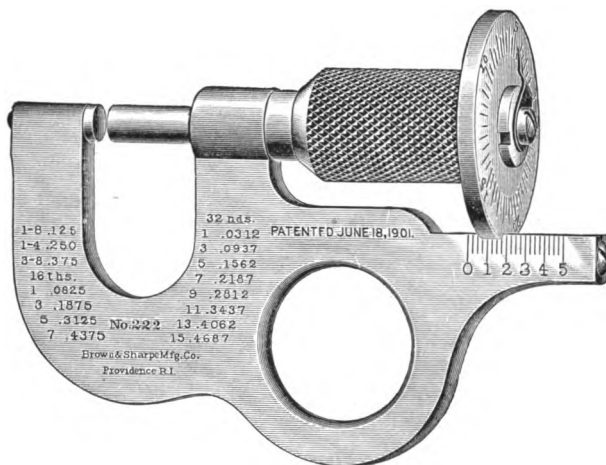
Packed singly in strong shipping cases.

Micrometer Caliper No. 222

ENGLISH OR METRIC MEASURE

Sheet Metal Gauge

Range, 0 to 1-2" or 0 to 13 mm



Price, \$9.00

Morocco Case, \$1.00

Micrometer Caliper No. 222, shown full size, is especially convenient for sheet metal workers and handlers.

By placing the middle finger of the right hand through the ring, the caliper is held at right angles to the sheet to be measured and readings made while in this position. The thimble is operated by the forefinger and thumb of the same hand.

To facilitate the reading of the caliper while held in position, the one-half thousandth readings are taken from the dial at the top of the spindle, the readings being indicated by the pointer; and the twenty-five thousandths readings, or those corresponding to the readings on the barrel of an ordinary Micrometer Caliper, are taken from the scale at the top of the frame.

The decimal equivalents stamped on the frame are convenient and render possible the immediate expression of readings in 8ths, 16ths, 32nds and 64ths of an inch.

English Measure. Measures all sizes less than one-half of an inch by one-half thousandths of an inch, and one-quarter thousandths are readily estimated.

Metric Measure. Also made to measure all sizes less than thirteen millimetres by hundredths of a millimetre.

When so made, the table of decimal equivalents is omitted.

Packed one in a box.

Micrometer Caliper No. 225

For Measuring the Thickness of Tubing

ENGLISH OR METRIC MEASURE

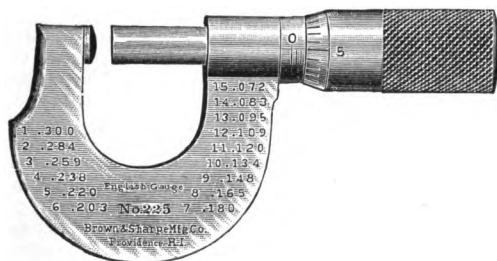
Range, 0 to 1-2" or 0 to 13 m/m

Price, \$8.00

With Ratchet Stop, \$8.50

Morocco Case, \$1.00

225



Shown full size, this Caliper is designed to accurately measure the thickness of tubing and is well adapted for use in tube works, boiler shops, etc.

The anvil or fixed measuring point is rounded on the end so that it touches at only one point on the inside of the tube, and the end of the movable spindle, being flat, touches at only one point on the outside, thus giving the exact thickness of the tube.

English Measure. Measures the thickness up to 1-2", by thousandths of an inch, of tubing from 5-16", inside diameter, upward.

The table of equivalents stamped on the frame determines the gauge number of the tubing in accordance with the English Standard.

Metric Measure. Also made to measure thickness up to 13 millimetres, by hundredths of a millimetre, of tubing from 8 millimetres, inside diameter, upward. When so made the table of equivalents is omitted.

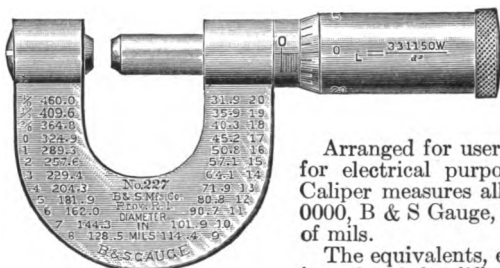
Packed one in a box.

Micrometer Caliper No. 227

FOR ELECTRICIANS

Range, 0 to 1-2"

Price, \$9.50 With Ratchet Stop, \$10.00 Morocco Case, \$1.00



Arranged for users of wire for electrical purposes, this Caliper measures all sizes to 0000, B & S Gauge, by 10ths of mils.

The equivalents, expressed in mils, of the different sizes

of wire from 0000 to 20, B & S Gauge, are stamped on one side of the frame and the circular mils of the same size on the other.

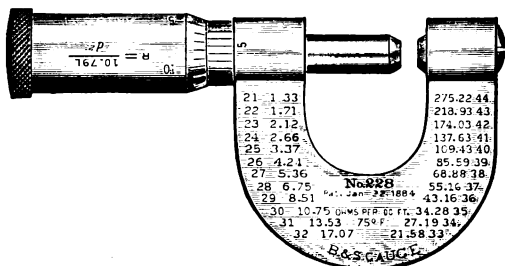
Three formulas are stamped on the thimble: one for the weight, length in feet and diameter being known; one for length in feet, weight and diameter being known; and one for resistance of commercial copper wire, in ohms per hundred feet at 75° F., length and diameter being known.

Micrometer Caliper No. 228

FOR ELECTRICIANS

Range, 0 to 1-2"

Price, \$9.50 With Ratchet Stop, \$10.00 Morocco Case, \$1.00



Differs from Micrometer Caliper No. 227 only in that the equivalents stamped on one side of the frame are for wire from 21 to 44, B & S Gauge, and the resistance of commercial copper wire, in ohms per hundred feet at 75° F., of the same sizes on the other.

Each of the above packed one in a box.

Paper Gauge Micrometer Caliper No. 230

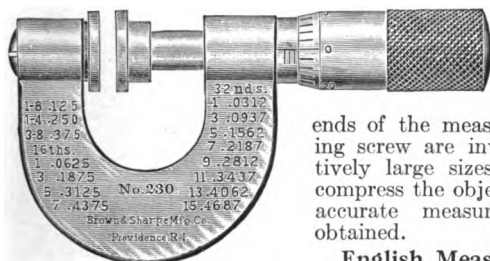
ENGLISH OR METRIC MEASURE

Range, 0 to 3-8" or 0 to 9 m/m

Price, \$9.50

With Ratchet Stop, \$10.00

Morocco Case, \$1.00



In measuring the thickness of paper, sheet rubber or other yielding substances, the disks shown on the

ends of the measuring spindle and adjusting screw are invaluable. The comparatively large sizes have less tendency to compress the objects measured and enable accurate measurements to be quickly obtained.

English Measure. Measures all sizes less than three-eighths of an inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than nine millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

Paper Gauge Micrometer Caliper No. 232

ENGLISH OR METRIC MEASURE

Range, 0 to 3-8" or 0 to 9 m/m

Price, \$12.50 With Ratchet Stop, \$13.00

Morocco Case, \$2.50



The opening in the frame is 2 inches deep, thus allowing the measurements to be taken at some distance from the edge of the paper.

The measuring spindle and adjusting screw are furnished with disks as shown.

English Measure. Measures all sizes less than three-eighths of an inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than nine millimetres by hundredths of a millimetre.

Each of the above packed one in a box.

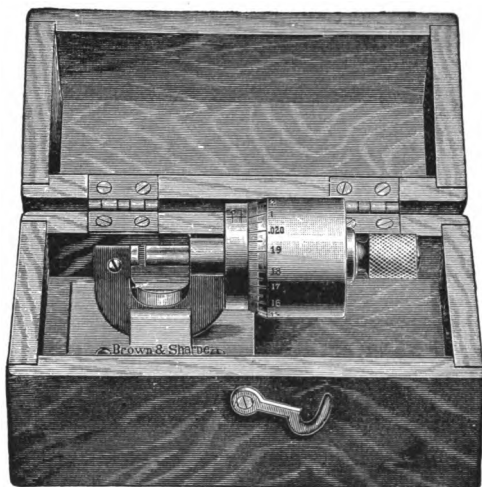
230

232

Micrometer Caliper No. 233

ENGLISH OR METRIC MEASURE

Range, 0 to 1-2" or 0 to 13 m/m



Price, in Case, \$27.50

This Caliper is found of service to wire drawers, watchmakers and others who desire fine measurements and whose work is of such a class that a Micrometer Caliper can be used when placed on a bench. It is shown half size.

English Measure. Measures all sizes less than one-half inch by **ten-thousandths** of an inch. The measurements can be read directly from the barrel. The screw has fifty threads and the barrel is divided into two hundred equal parts.

Metric Measure. Also made to measure all sizes less than thirteen millimetres by one two-hundredth of a millimetre.

Packed one in a box.

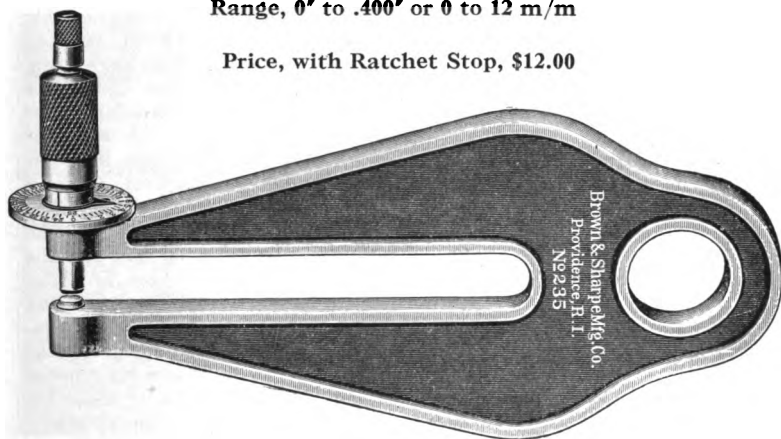
Micrometer Caliper No. 235

Rolling-Mill Gauge

ENGLISH OR METRIC MEASURE

Range, 0" to .400" or 0 to 12 m/m

Price, with Ratchet Stop, \$12.00



Shown about one-half size, this Micrometer Caliper is well adapted to sheet metal workers' use.

The gauge screw is encased and protected from dirt and injury. Means of adjustment are provided to compensate for wear.

The opening in the frame is about 4 1-2" deep, a feature much appreciated, as it enables sheet metal to be more accurately measured than would be possible with an ordinary Micrometer.

The caliper differs slightly in design from the regular caliper in the method of obtaining readings.

English Measure. The thousandths readings, usually taken from the sleeve, are taken from a dial graduated into 25 equal parts; and by means of the pointer, readings up to four hundred thousandths can be easily made by one-half thousandths of an inch. For convenience in reading, the hub is graduated on opposite sides.

Metric Measure. Also made to measure all sizes less than twelve millimetres by hundredths of a millimetre.

A Ratchet Stop that enables measurements to be quickly and accurately made is provided.

Packed one in a box.

235

Micrometer Caliper No. 237

Rolling-Mill Gauge

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$12.50

With Ratchet Stop, \$13.00

Morocco Case, \$2.50



Designed for sheet metal workers' use, this Caliper is also adapted for a wide range of other uses requiring a caliper of unusual depth. The opening in the frame is about 3" deep, a feature much appreciated, as it enables sheet metal to be more ac-

curately measured than would be possible with an ordinary micrometer.

English Measure. Measures all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.

Micrometer Caliper No. 238

Rolling-Mill Gauge

ENGLISH OR METRIC MEASURE

Range, 0 to 1-2" or 0 to 13 m/m

Price, \$10.75

With Ratchet Stop, \$11.25

Differs from Micrometer Caliper No. 237 only in having a smaller range. Opening in frame about 2" deep.

Micrometer Caliper No. 239

Rolling-Mill Gauge

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, with Ratchet Stop, \$14.50

Differs from Micrometer Caliper No. 237 only in having a deeper opening in the frame, this being about 6" deep. It is regularly furnished with Ratchet Stop.

Each of the above packed one in a box.

Hub Micrometer Caliper No. 241

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

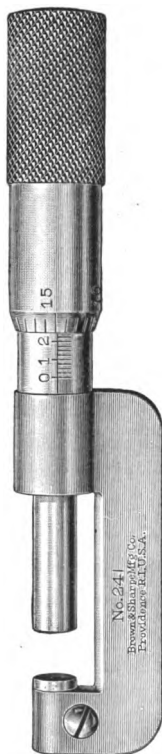
Price, \$9.50 With Ratchet Stop, \$10.00 Morocco Case, \$1.00

A convenient Caliper for use in determining the thickness at the centre of saws, the exact hub lengths of cutters, and similar measurements on other articles.

For this reason the frame is made so that it will pass through a 3-4" hole.

English Measure. Measures all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.



Packed one in a box.

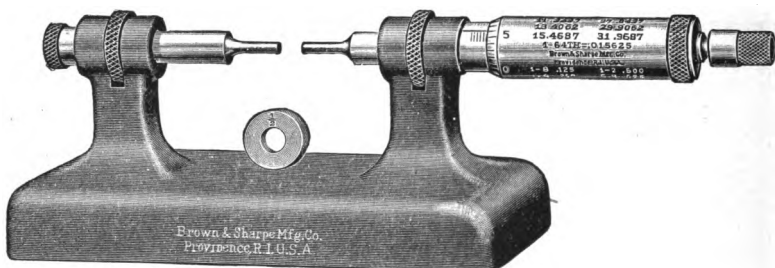
243

Bench Micrometer Caliper No. 243

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$12.00



Designed with reference to the wants of watchmakers, inspectors, manufacturing jewelers, etc., who frequently require a micrometer caliper for quick, accurate measurements on work at the bench. For this purpose it is made with a heavy base, insuring rigidity and preventing it from being easily upset.

The measuring points are 5-64" (.078") diameter.

English Measure. Measures all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.

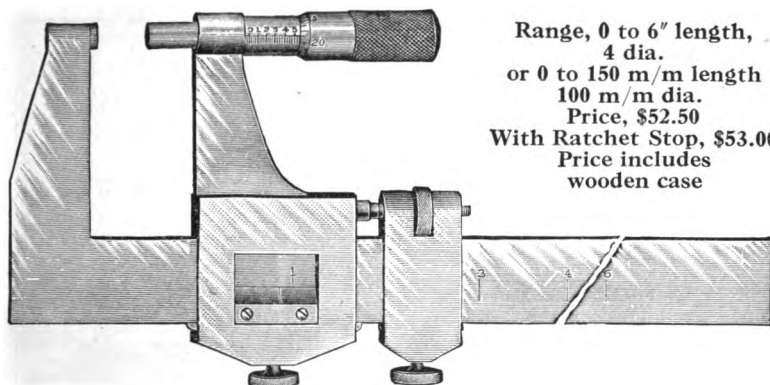
A **Clamp Ring**, which clamps the spindle and preserves the setting, and a **Ratchet Stop** are provided.

A **Standard Gauge** to be used in adjusting the caliper is also furnished.

Packed one in a box.

Micrometer Caliper No. 245

ENGLISH OR METRIC MEASURE



Range, 0 to 6" length,
4 dia.

or 0 to 150 m/m length
100 m/m dia.

Price, \$52.50

With Ratchet Stop, \$53.00

Price includes
wooden case

The slide can be set accurately by means of the graduated lines on the bar.

Measurements are obtained by means of a micrometer screw.

English Measure. Measures all sizes less than six inches in length and four inches in diameter, by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than 150 millimetres in length and 100 millimetres in diameter by hundredths of a m/m.

Micrometer Caliper No. 246

ENGLISH OR METRIC MEASURE

Range 0 to 12" length, 6" dia., or 0 to 300 m/m length, 150 m/m dia.

Price, \$59.00

With Ratchet Stop, \$59.50

Differs from Micrometer Caliper No. 245 only in its range.

English Measure. Measures all sizes less than twelve inches in length and six inches in diameter by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than 300 millimetres in length and 150 millimetres in diameter by hundredths of a m/m.

Micrometer Caliper No. 248

ENGLISH OR METRIC MEASURE

Range, 0 to 24" length, 6" dia. or 0 to 600 m/m length, 150 m/m dia.

Price, \$76.00

With Ratchet Stop, \$76.50

Differs from Micrometer Caliper No. 245 only in its range.

English Measure. Measures all sizes less than twenty-four inches in length and six inches in diameter by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than 600 millimetres in length and 150 millimetres in diameter by hundredths of a m/m.

Packed one in a box.

Depth of Gear Tooth Micrometer No. 249

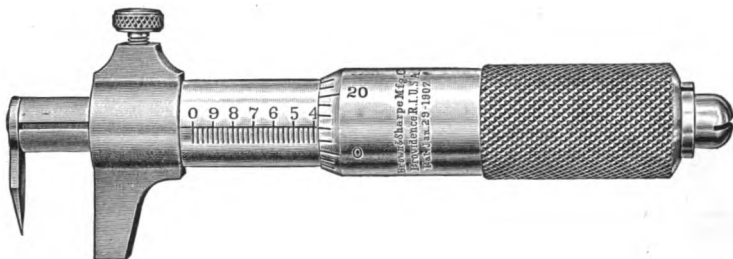
ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m

Price, \$8.50

Morocco Case, \$1.00

Patented January 29, 1907



Designed for scribing a line on gear blanks to accurately indicate the extreme depth to cut the teeth. For this purpose it is a particularly economical tool in that it does away with the necessity of keeping a large number of separate gauges for the different pitches.

Toolmakers will also find it handy as a scratch gauge in scribing lines and measuring spacing within its range. The scriber point is hardened.

English Measure. Made to measure all sizes less than one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.

A Clamp Screw, which clamps the spindle and preserves the setting, is provided.

Extra Scriber Points, Price, 40 cents each

Packed one in a box.

Inside Micrometer Caliper No. 250

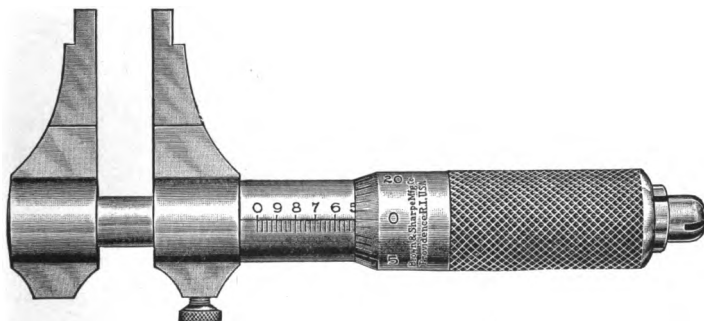
Patented January 29, 1907

ENGLISH OR METRIC MEASURE

Range, .200" to 1" or 5 m/m to 25 m/m

Price, \$14.00

Morocco Case, \$1.00



Meets the demand for a tool adapted to measure small internal dimensions.

The measuring screw is entirely enclosed, thus protecting it from dirt and injury.

The measuring surfaces are hardened and ground to a radius to insure accurate measurements and prevent cramping when measuring parallel surfaces.

English Measure. Measures all sizes from two-tenths to one inch by thousandths of an inch.

Metric Measure. Also made to measure all sizes from five m/m to twenty-five m/m by hundredths of a millimetre.

A **Clamp Screw**, which clamps the spindle and preserves the setting, is provided.

Packed one in a box.

Inside Micrometer Caliper No. 252

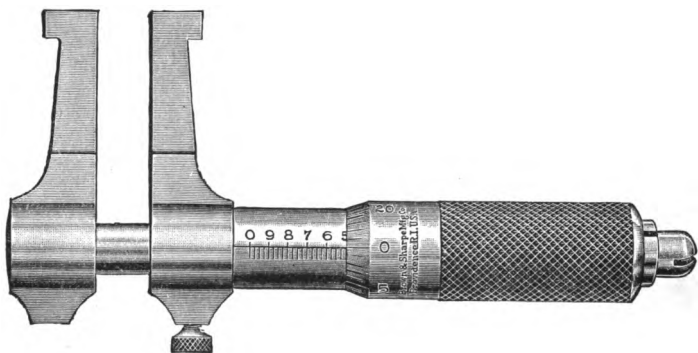
ENGLISH OR METRIC MEASURE

Range, 1-2" to 1 1-2" or 12 m/m to 37 m/m

Price, \$15.00

Morocco Case, \$1.00

Patented January 29, 1907



Differs from Micrometer Caliper No. 250, shown on the preceding page, only in the shape of the jaws. This is a feature permitting inside measurements over a flange or shoulder which could not be made with the other style of jaws.

Inside Micrometer Caliper No. 254

Patented January 29, 1907

ENGLISH OR METRIC MEASURE

Range, 1" to 2" or 25 m/m to 50 m/m

Price, \$15.00

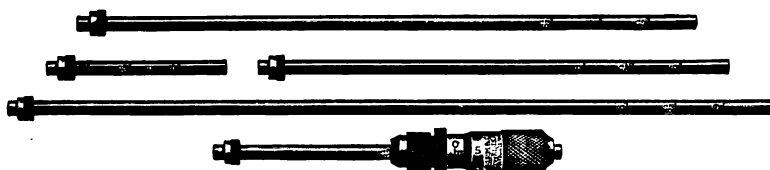
Morocco Case, \$1.00

Differs from Micrometer Caliper No. 252 only in its range.

Each of the above packed one in a box.

Inside Micrometers Nos. 260 and 261

ENGLISH OR METRIC MEASURE



260

261

These consist of a holder with a micrometer screw and thimble. The extension rods are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustments to be quickly and positively made.

English Measure. Measure by thousandths of an inch.

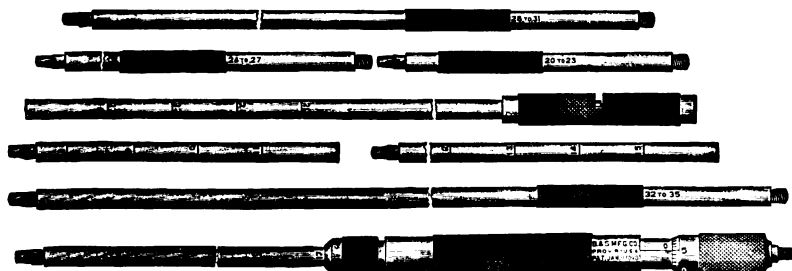
Metric Measure. Also made to measure by hundredths of a millimetre.

262

No.	No. of Rods	Range	Price without Case	Price with Case
260	5	2" to 9 1-2"	\$9.00	\$10.25
	6	50 m/m to 230 m/m	9.00	10.25
	7	2" to 12 1-2"	10.50	12.00
261	8	50 m/m to 200 m/m	10.50	12.00

Inside Micrometer No. 262

ENGLISH OR METRIC MEASURE



These consist of a holder with a micrometer screw and thimble. The extension rods are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustments to be quickly and positively made.

English Measure. Measure by thousandths of an inch.

Metric Measure. Also made to measure by hundredths of a millimetre.

No.	No. of Rods	Range	Price without Case	Price with Case
262	8	8" to 36"	\$13.00	\$15.50
	8	200 m/m to 900 m/m	13.00	15.50

Each of the above packed one set in a box.

Tubular Inside Micrometers



The Tubular Inside Micrometers are made of tubing, which renders them very light and convenient to handle, especially those of the longer lengths.

These micrometers are designed for measuring the inside diameters of rings, cylinders, etc., setting calipers, comparing gauges and work of a similar nature. They are fitted at one end with a micrometer head having a 1-2" or 1" (Metric, 13 or 25 m/m) movement. The measuring points are hardened; and the faces are ground on a radius, thus adapting them especially for measuring parallel or curved surfaces.

Fibre grips are provided to guard against inaccuracies due to the heat of the hand. The small sizes have only one grip, while the larger sizes have two.

English Measure. Measure by thousandths of an inch.

Metric Measure. Also made to measure by hundredths of a millimetre.

A Clamp Screw, which clamps the spindle and preserves the setting, is provided.

Tubular Inside Micrometers No. 270

No.	Range, Inches	Price	Range, Inches	Price	Range, Inches	Price
270	2 to 2 1-2	\$6.00 each	12 to 13	\$7.00 each	26 to 27	\$8.25
	2 1-2 to 3		13 to 14		27 to 28	
	3 to 3 1-2		14 to 15		28 to 29	9.75 each
	3 1-2 to 4		15 to 16	7.50 each	29 to 30	
	4 to 4 1-2		16 to 17		30 to 31	11.25 each
	4 1-2 to 5	6.50 each	17 to 18		31 to 32	
	5 to 6		18 to 19		32 to 33	
	6 to 7		19 to 20		33 to 34	
	7 to 8		20 to 21	8.25 each	34 to 35	
	8 to 9		21 to 22		35 to 36	13.00 each
	9 to 10	7.00 each	22 to 23		36 to 37	
	10 to 11		23 to 24		37 to 38	
	11 to 12		24 to 25		38 to 39	
			25 to 26		39 to 40	

Tubular Inside Micrometers No. 272

METRIC MEASURE

No.	Range, Millimetres	Price	Range, Millimetres	Price	Range, Millimetres	Price
272	50 to 63	\$6.00 each	300 to 325	\$7.00 each	650 to 675	\$8.25
	63 to 75		325 to 350		675 to 700	
	75 to 88		350 to 375		700 to 725	
	88 to 100		375 to 400		725 to 750	
	100 to 113	6.50 each	400 to 425	7.50 each	750 to 775	11.25 each
	113 to 125		425 to 450		775 to 800	
	125 to 150		450 to 475		800 to 825	
	150 to 175		475 to 500		825 to 850	
	175 to 200	7.00 each	500 to 525	8.25 each	850 to 875	13.00 each
	200 to 225		525 to 550		875 to 900	
	225 to 250		550 to 575		900 to 925	
	250 to 275		575 to 600		925 to 950	
	275 to 300		600 to 625		950 to 975	
			625 to 650		975 to 1000	

Packed one in a box.

Tubular Inside Micrometer Set No. 273

ENGLISH OR METRIC MEASURE

7 Micrometers, Range 2" to 6", or 50 m/m to 150 m/m

* Price, \$42.50

Tubular Inside Micrometer Set No. 274

ENGLISH OR METRIC MEASURE

13 Micrometers, Range 2" to 12", or 50 m/m to 300 m/m

* Price, \$82.50

Tubular Inside Micrometer Set No. 285

ENGLISH OR METRIC MEASURE

41 Micrometers, Range 2" to 40", or 50 m/m to 1000 m/m

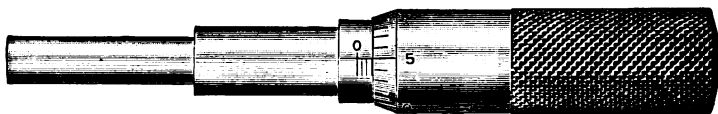
* Price, \$345.75

This set includes all of the English Tubular Inside Micrometers listed under No. 270, or Metric Tubular Micrometers listed under No. 272.

* Price of this set includes a suitable wooden case

Each of the above packed one set in a box.

Micrometer Heads



Adapted for use on special gauges of various kinds, as they enable variations to be quickly read. They can be readily attached to machines or tools and applied to a great variety of uses to which the usual fixed gauges are not adapted.

English Measure. Measure by thousandths of an inch within their respective ranges.

Metric Measure. Also made to measure by hundredths of a millimetre. Micrometer Head No. 290, Metric, measures all sizes less than thirteen millimetres, while Micrometer Head No. 294, Metric, has a range of twenty-five millimetres.

The 1-2" Micrometer Heads differ from the 1" only in the size and range.

1-2 Inch Micrometer Head No. 290

ENGLISH OR METRIC MEASURE

Price, with or without Ratchet Stop, \$4.50

Length from lower end of barrel to shoulder, 3-8"; diameter of barrel, 3-8".

1-2 Inch Micrometer Head No. 291

Price, with or without Ratchet Stop, \$6.25

Differs from Micrometer Head No. 290, English measure, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

1-Inch Micrometer Head No. 294

ENGLISH OR METRIC MEASURE

Price, with or without Ratchet Stop, \$5.50

Length from lower end of barrel to shoulder, 3-4"; diameter, 3-8".

1-Inch Micrometer Head No. 295

Price, with or without Ratchet Stop, \$7.25

Differs from Micrometer Head No. 294, English measure, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

The 1" Micrometer Heads will be furnished, at the above prices, with **Clamp Screws**, to clamp the spindle and preserve the setting, when so ordered.

Packed one in a box.

Standards of Length

THE Standard Yard was first legalized in England in 1824; this Standard, however, was destroyed in 1834. The Standard Imperial Yard, "Bronze No. 1," was then prepared and legalized in 1855. Forty copies were made and one of these, "Bronze No. 11," was presented to the United States by the British Government in 1856. At the same time another copy, known as "Low Moor Iron No. 57," was sent. These were accurately compared, before being sent, with the Standard Imperial Yard, and the record of the variations sent with them.

The use of the Metre as a Standard in this country was legalized in 1866 and prototypes of the original Metre Bar were prepared in 1899, one of these, which was sent to Washington, now being used as the basis of "Metric Measurements," in this country.

We prepared Standards for use in our own shops, and after their completion, they were compared by the Government officials with the Standards in Washington.

The mean errors were found to be: for the Yard .00002", and for the Metre .000005 M., both being too long.

These Standards have been subdivided with the greatest care and accuracy and our Rules are as nearly exact copies as expert mechanical skill, aided by machines especially designed for the purpose, can make them.

Graduations

Our Tempered Rules are divided into parts of an inch, as follows:

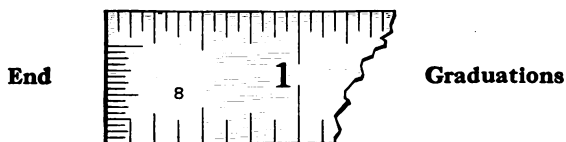
No. 1 Graduation	No. 2 Graduation	No. 4 Graduation
1st corner, 10, 20, 50, 100	8	8
2d corner, 12, 24, 48	10, 20, 50, 100	16
3d corner, 14, 28	12, 24, 48	32
4th corner, 16, 32, 64	16, 32, 64	64

No. 7 Graduation

16
32
64
100

No. 10 Graduation	No. 11 Graduation	No. 12 Graduation
1st corner, 32	64	50
2d corner, 64	100	100

Metric Rules are graduated to read by half millimetres, millimetres, or both.



All Tempered Steel Rules 2" to 12" in length with No. 4 Graduation are furnished with End Graduations, reading to 32nds of an inch on two ends of one side. This feature will be found advantageous in measuring the depth and width of grooves, countersinks and recesses of various kinds.

Tempered Steel Rules No. 300



These rules are about 1-20" thick

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
300	1	29-64	4	\$0.25
	2	1-2	4 or 7	.40
	3	35-64	4 or 7	.50
	4	19-32	4 or 7	.60
	6	11-16	1, 2, 4 or 7	.80
	9	53-64	4 or 7	1.20
	12	31-32	1, 2, 4, or 7	1.50
	18	1	4 or 7	2.40
	24	1	4 or 7	3.00
	36	1	4 or 7	6.00
	*48	1 1-2	4 or 7	8.40

* This rule is not tempered.

Tempered Steel Rules No. 301

METRIC MEASURE

First corner graduated to half millimetres, remaining three corners to millimetres.

No.	Length	Price	Length	Price
301	10 Centimetres	\$0.60	30 Centimetres	\$1.50
	15 Centimetres	.80	50 Centimetres	2.40
	20 Centimetres	1.00		

Tempered Steel Rules No. 302

ENGLISH AND METRIC MEASURE

First corner graduated for 2" by 64ths of an inch, the remainder to lengths shown in the list below by 16ths of an inch; second corner by millimetres to full length of rule; third corner, 2" by 100ths of an inch, the remainder by 50ths of an inch; fourth corner by half millimetres.

No.	Length		Price
302	† 10 Centimetres	{ 64ths to 3 7-8" 100ths to 3 9-10"	\$0.60
	English Graduations		
	† 15 Centimetres	{ 64ths to 5 7-8" 100ths to 5 8-10"	.80
	English Graduations		
	20 Centimetres	{ 64ths to 7 3-4" 100ths to 7 8-10"	1.00
	English Graduations		
	30 Centimetres	{ 64ths to 11 5-8" 100ths to 11 7-10"	1.50
	English Graduations		
	50 Centimetres	{ 64ths to 19 1-2" 100ths to 19 6-10"	2.40
	English Graduations		

† First corner graduated to 64ths of an inch, second corner to millimetres, third corner to 100ths of an inch, fourth corner to half millimetres.

Each of the above packed six in a box, except 18" to 48" (and 50 c/m), which are packed one in a package.

Narrow Tempered Steel Rules No. 303



These rules are about 1-20" thick and about 7-32" wide. Graduated on one corner of each side only.

No.	Length, Inches	No. of Graduation	Price
303	4	10 or 11	\$0.60
	6	10 or 11	.80
	9	10 or 11	1.20
	12	10 or 11	1.50

Narrow Tempered Steel Rules No. 304

METRIC MEASURE

Graduated on one corner of each side only. First corner graduated to half millimetres, second corner to millimetres.

No.	Length	Price
304	10 Centimetres	\$0.60
	15 Centimetres	.80
	20 Centimetres	1.00
	30 Centimetres	1.50

Narrow Tempered Steel Rules No. 305

ENGLISH AND METRIC MEASURE

Graduated on one corner of each side only. First corner graduated to lengths shown in the list below by 64ths of an inch, second corner to full length of rule by half millimetres.

No.	Length	Price
305	10 Centimetres	\$0.60
	English Graduations to 3 7-8"	
	15 Centimetres	.80
	English Graduations to 5 7-8"	
	20 Centimetres	1.00
	English Graduations to 7 13-16"	
	30 Centimetres	1.50
	English Graduations to 11 3-4"	

For Graduations, see page 60
Each of the above packed six in a box.

Flexible Steel Rules No. 306



Graduated on one side only

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
306	4	1-2	10	\$0.60
	6	1-2	10, 11 or 12	.80
	9	1-2	10	1.20
	12	1-2	10, 11 or 12	1.50
	18	3-4	10	2.40
	24	3-4	10	3.00

Flexible Steel Rules No. 307

METRIC MEASURE

Graduated on one side only. First corner graduated to half millimetres, second corner to millimetres.

No.	Length	Price
307	10 Centimetres	\$0.60
	15 Centimetres	.80
	30 Centimetres	1.50

Flexible Steel Rules No. 308

ENGLISH AND METRIC MEASURE

Graduated on one side only. First corner graduated to lengths shown in the list below by 64ths of an inch, second corner to full length of rule by half millimetres.

No.	Length	Price
308	10 Centimetres	\$0.60
	English Graduations to 3 7-8"	
	15 Centimetres	.80
	English Graduations to 5 3-4"	
	30 Centimetres	1.50
	English Graduations to 11 3-4"	

For Graduations, see page 60.

Packed six in a box, except 18" and 24", which are packed one in a package.

Tempered Steel Rules No. 315

With Figured Graduations



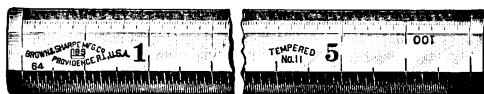
Furnished with the 64th graduations numbered every eighth graduation line, as 8, 16, 24, etc. This assists the user in quickly ascertaining the number of 64ths in 1-8", 1-4", 1-2", 3-4", etc.

Furnished with No. 4 Graduation only.

No.	Length, Inches	Approximate Width, Inches	Approximate Thickness, Inches	Price
315	1	29-64	1-20	\$0.25
	2	1-2	1-20	.40
	3	35-64	1-20	.50
	4	19-32	1-20	.60
	6	11-16	1-20	.80
	9	53-64	1-20	1.20
	12	31-32	1-20	1.50
	18	1	1-20	2.40
	24	1	1-20	3.00

Tempered Steel Rules No. 318

With Beveled Edges



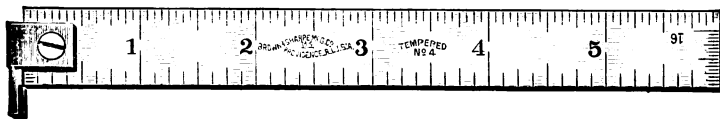
Beveled on both edges of one side. Graduated on the beveled edges only.

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
318	1	5-8	10 or 11	\$0.50
	2	5-8	10 or 11	.65
	3	5-8	10 or 11	.85
	4	5-8	10 or 11	1.00
	6	11-16	10 or 11	1.20
	9	53-64	10 or 11	1.50
	12	1	10 or 11	1.80
	18	1	10 or 11	3.90
	24	1	10 or 11	4.80

For Graduations, see page 60.

Each of the above packed six in a box, except 18" and 24", which are packed one in a package.

Tempered Hook Rules No. 320



The Hook Rules listed on this page are our latest design. The hardened hook is **reversible** and attached to the rule in what we believe to be the simplest and most practical manner yet devised, being held by a single screw. *It cannot pull off.*

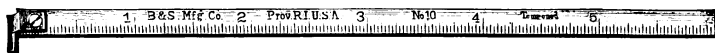
When it is desired to use the rule as a standard steel rule, the hook may be quickly detached and the screw replaced in the hook. There are no loose parts to be lost.

The rules are convenient for measuring diameters of flanges or circular pieces, through the hubs of pulleys, setting calipers and dividers and work of a similar character.

No.	Length, Inches	Approximate Width, Inches	Number of Graduation	Price
320	4	19-32	4	\$1.00
	6	11-16	4	1.20
	9	53-64	4	1.70
	12	31-32	4	2.10
	18	1	4	3.00
	24	1	4	3.60
	36	1	4	6.90

Packed six in a box, except 18", 24" and 36", which are packed one in a package.

Narrow Tempered Hook Rules No. 325



Differ from Hook Rules No. 320 only in that the rules are narrow and allow measurements to be taken through a hole 3-8" in diameter.

No.	Length, Inches	Number of Graduation	Price
325	4	10	\$0.90
	6	10	1.10
	9	10	1.50
	12	10	1.80

Hook Rules furnished with metric graduations when ordered. Prices as listed above. For Graduations, see page 60.

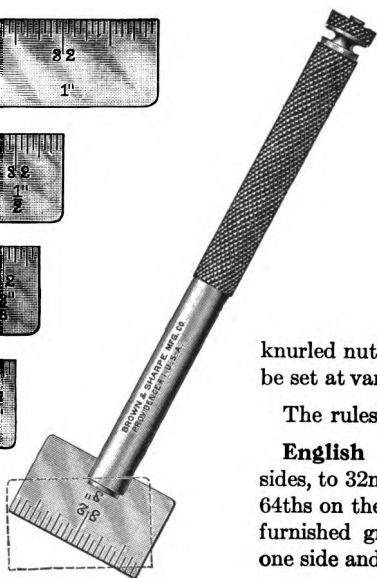
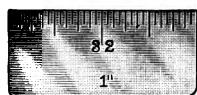
Packed six in a box.

Steel Rules with Holder No. 335

ENGLISH OR METRIC MEASURE

5 Rules Interchangeable in One Holder

Price, \$2.50



The rules and holder, shown full size, are convenient where the ordinary rule cannot be used, as in measuring a recess or key-way as well as the general class of tool and die work.

The holder takes either of the five sizes of rules. The barrel is knurled for finger grip. The rules are held in a split chuck, adjusted by a knurled nut at the top of the barrel and can be set at various angles according to the work.

The rules are of tempered steel.

English Measure. Graduated on both sides, to 32nds of an inch on one side and to 64ths on the other. The 1" and 1-2" are also furnished graduated to 50ths of an inch on one side and 100ths on the other.

Metric Measure. Also furnished graduated on one side to millimetres and on the other side to half millimetres. Separate parts may be bought as follows:

Length	Price Without Holder	Price With Holder
1-4" or 5 m/m	\$0.35	\$1.10
3-8" or 10 m/m	.35	1.10
1-2" or 15 m/m	.35	1.10
3-4" or 20 m/m	.35	1.10
1" or 25 m/m	.35	1.10

Holder, Price, \$0.75

Packed one in a box.

Tempered Steel Shrink Rules

Nos. 340, 341, 342, 343, 344, 345 and 346

Graduated on Both Sides



Number	Shrink per Foot	Length, Inches	No. of Graduation	Price
340	1-10	6 1-20	4	\$0.90
	1-10	12 1-10	4	2.10
	1-10	24 1-5	4	4.25
341	1-8	6 1-16	4	.90
	1-8	12 1-8	4	2.10
	1-8	24 1-4	4	4.25
342	3-16	12 3-16	4	2.10
	3-16	24 3-8	4	4.25
343	1-4	6 1-8	4	.90
	1-4	12 1-4	4	2.10
	1-4	24 1-2	4	4.25
344	5-16	12 5-16	4	2.10
	5-16	24 5-8	4	4.25
345	5-32	12 5-32	4	2.10
	5-32	24 5-16	4	4.25
346	3-8	12 3-8	4	2.10
	3-8	24 3-4	4	4.25

For Graduations, see page 60.

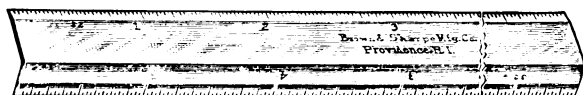
Packed six in a box.

Work-Basket Rule No. 372

Price, \$1.00

The rule is 6" long, 1" wide and 1-40" thick, made of steel and nickel plated. It is light and serviceable. Graduated on one side to 8ths and on the other side to 8ths and 16ths of an inch.

Key Seat Rules No. 374



Parallel lines for key seats, mortises, etc., can be readily and accurately drawn on shafts not less than 7-8" in diameter with these rules.

The edges are beveled. Graduated to 32nds of an inch.

No.	Length, Inches	Price
374	4	\$3.00
	6	3.60
	8	4.50

Key Seat Rules No. 375

METRIC MEASURE

Differ from Key Seat Rules No. 374 only in reading to metric measure. Graduated to half millimetres.

No.	Length, c/m	Price
375	10	\$3.00
	15	3.60
	20	4.50

Each of the above packed six in a box.

6-Inch Rule with Slide No. 380

ENGLISH OR METRIC MEASURE



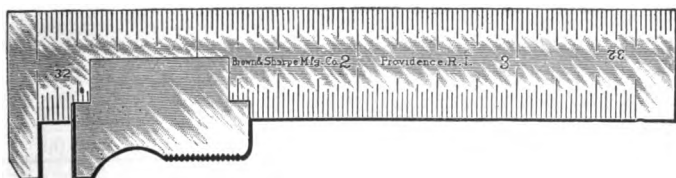
Price, \$1.50

English Measure. This Rule is 6" long, about 9-16" wide, 1-16" thick, and is furnished with No. 4 Graduation. For List of Graduations, see page 60.

Metric Measure. Graduated on three corners to millimetres and on one corner to half millimetres.

Slide Caliper Rule No. 385

ENGLISH OR METRIC MEASURE



Price, \$1.80

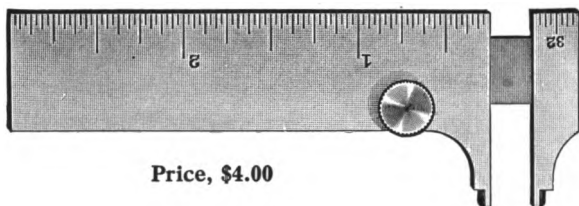
English Measure. The Slide Caliper Rule shown in cut is of steel, 4 3-16" long and 1-16" thick. Graduated on both corners to 32nds of an inch. The jaws are 3-8" deep.

Metric Measure. Graduated to half millimetres.

Each of the above packed six in a box.

Pocket Slide Caliper Rule No. 388

ENGLISH OR METRIC MEASURE



Price, \$4.00

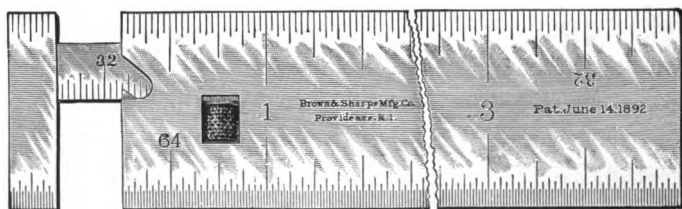
English Measure. Graduated on one corner of one side to 32nds. On the other side the slide is graduated to 64ths and has a range of 2".

The jaws are 5-8" deep. The nibs can be inserted in holes 1-8" in diameter.

Metric Measure. Graduated to millimetres and half millimetres.

When the slide is set for any particular measurement, it can be securely clamped in position by a **Clamp Nut**.

Steel Caliper Rules No. 391



No.	Length, Inches	Price
391	3	\$4.20
	4	5.00

Convenient for use in the stock room or store, in selecting sheet or bar stock, wire, tubing, etc. The slide of the 3" can be drawn out to measure 2 1-4", and that of the 4" to measure 3 1-4".

The 3" rule can be furnished nickel plated when desired. Price, 60 cents extra.

They are divided into parts of an inch as follows:

	C	D
1st corner	8	8
2nd corner	16	16
3rd corner	32	32
4th corner	64	64
Slide	32 and 64	64 and 100

In ordering state whether style C or D is desired.

Each of the above packed six in a box.

Steel Caliper Rules No. 392

METRIC MEASURE

No.	Length m/m	Price
392	75	\$4.20
	100	5.00

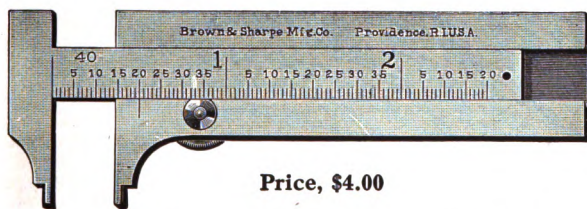
The slide of the 75 m/m can be drawn out to measure 50 m/m and that of the 100 m/m to measure 75 m/m. They are graduated to millimetres and half millimetres.

Button Rule No. 397

Price, \$4.20

Differs from the 3" Steel Caliper Rule, No. 391, only in that the outside is graduated to 16ths, 20ths, 32nds, and 40ths of an inch, and the slide to 40ths and 80ths of an inch.

Pocket Button Rule No. 398



Price, \$4.00

This Pocket Slide Caliper Rule or Button Rule is exceptionally convenient to use and will fit easily into the pocket when not in use.

On one side it is graduated as an ordinary 3" rule, the graduations reading to 32nds of an inch. On the other side it is used as a button rule, the graduations on the slide reading to 40ths of an inch. It has a range of 2" and both external and internal measurements can be made.

When the slide is set for any particular measurement, it can be securely clamped in position by a **Clamp Nut**.

Each of the above packed six in a box.

B & S Protractors, Combination Squares and Combination Sets

THESE Protractors, Squares and Sets are made with the same care and attention to detail as is given all of our tools.

The squares and centre heads are drop forged and superior to those of cast iron. This feature is readily appreciated by mechanics, as it contributes much to the lightness, durability and convenience of the tool.

In the Protractors, the revolving turret which carries the blade is fitted to a nicety and accurately graduated, being engine divided to 90° either side of zero, and every care taken to insure the zero being at right angles to the face of the head. It can be set at any angle and rigidly clamped by a thumb nut.

An important feature is the round clamping groove in the blade. This allows the head to be quickly clamped and forces the blade against the side of the slot square with the face of the head. It also admits the use of a stronger blade and clamping bolt than does the usual square groove and presents no sharp corners to collect dirt and impair the accuracy of the tool.

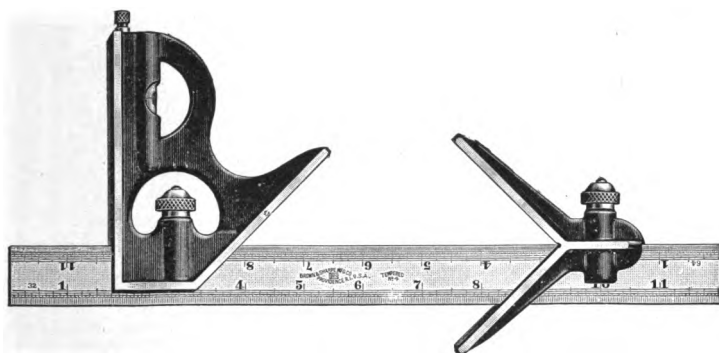
Parallel lines running lengthwise of the blade are provided to aid in reading the various parts of an inch. The levels, which are such important adjuncts to tools of this kind, are accurately set and fastened to the side of the turret and in a protected position on the square head.

Another important feature is that all parts of these squares are made interchangeable, thus allowing repairs to be made by simply ordering the part needed and avoiding the necessity of returning the tool.

The blades are furnished tempered as listed and are graduated with the same care and accuracy that have made our steel rules recognized as standards of accuracy.

B & S Combination Squares

ENGLISH, METRIC OR ENGLISH AND METRIC



With Hardened Heads			With Soft Heads		
No.	Size	Price	No.	Size	Price
400 English	6 inch	\$3.90	402 English	6 inch	\$3.00
	9 "	4.50		9 "	3.60
	12 "	4.80		12 "	3.90
	18 "	6.00		18 "	5.10
	24 "	6.60		24 "	5.70
404 Metric	15 c/m	\$3.90	406 Metric	15 c/m	\$3.00
	20 "	4.50		20 "	3.60
	30 "	4.80		30 "	3.90
	50 "	6.00		50 "	5.10
	60 "	6.60		60 "	5.70
408 English and Metric	15 c/m	\$3.90	410 English and Metric	15 c/m	\$3.00
	20 "	4.50		20 "	3.60
	30 "	4.80		30 "	3.90
	50 "	6.00		50 "	5.10
	60 "	6.60		60 "	5.70

All blades are tempered.

Blades on Nos. 400 and 402 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on Nos. 404 and 406 are graduated as follows: 1st and 3rd corners to millimetres; 2nd and 4th corners to half millimetres.

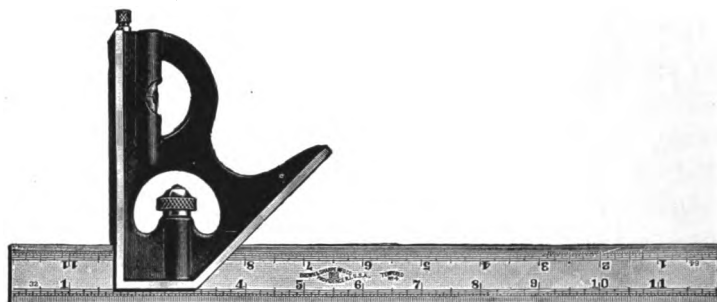
Blades on Nos. 408 and 410 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Combination Squares

Without Centre Head

ENGLISH, METRIC OR ENGLISH AND METRIC



With Hardened Heads

With Soft Heads

No.	Size	Price	No.	Size	Price
401 English	4 inch	\$2.40	403 English	4 inch	\$2.10
	6 "	3.00		6 "	2.40
	9 "	3.60		9 "	2.70
	12 "	3.90		12 "	3.00
	18 "	5.10		18 "	4.20
	24 "	5.70		24 "	5.10
405 Metric	10 c/m	\$2.40	407 Metric	10 c/m	\$2.10
	15 "	3.00		15 "	2.40
	20 "	3.60		20 "	2.70
	30 "	3.90		30 "	3.00
	50 "	5.10		50 "	4.20
	60 "	5.70		60 "	5.10
409 English and Metric	10 c/m	\$2.40	411 English and Metric	10 c/m	\$2.10
	15 "	3.00		15 "	2.40
	20 "	3.60		20 "	2.70
	30 "	3.90		30 "	3.00
	50 "	5.10		50 "	4.20
	60 "	5.70		60 "	5.10

All blades are tempered.

Blades on Nos. 401 and 403 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on Nos. 405 and 407 are graduated as follows: 1st and 3rd corners to millimetres; 2nd and 4th corners to half millimetres.

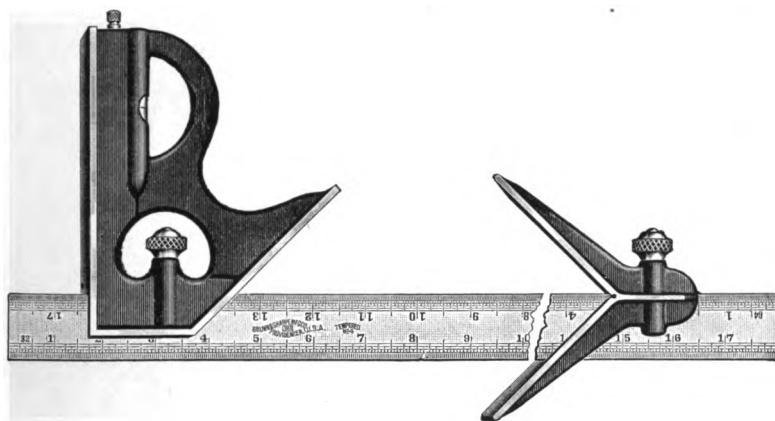
Blades on Nos. 409 and 411 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Combination Squares

Heavy

ENGLISH OR ENGLISH AND METRIC



With Hardened Heads

No.	Size	Price
412 English	18 inch 24 "	\$9.60 11.10
420 English and Metric	50 c/m 60 "	\$9.60 11.10

With Soft Heads

No.	Size	Price
414 English	18 inch 24 "	\$8.70 10.20
422 English and Metric	50 c/m 60 "	\$8.70 10.20

All blades are tempered.

Blades on Nos. 412 and 414 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on Nos. 420 and 422 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

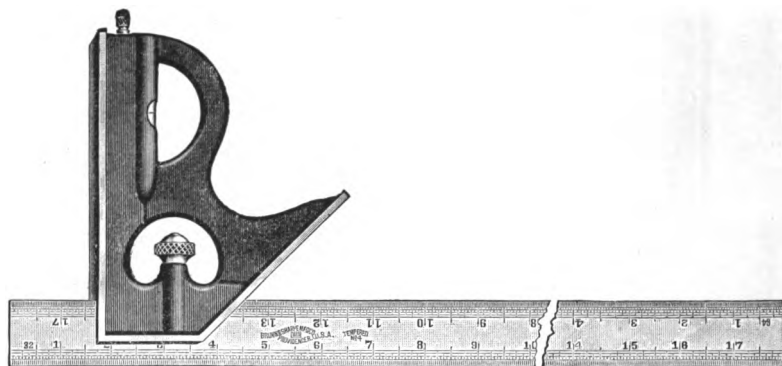
Packed one in a box.

B & S Combination Squares

Heavy

Without Centre Head

ENGLISH OR ENGLISH AND METRIC



With Hardened Heads			With Soft Heads		
No.	Size	Price	No.	Size	Price
413 English	18 inch 24 "	\$7.20 8.70	415 English	18 inch 24 "	\$6.60 8.10
421 English and Metric	50 c/m 60 "	\$7.20 8.70	423 English and Metric	50 c/m 60 "	\$6.60 8.10

All blades are tempered.

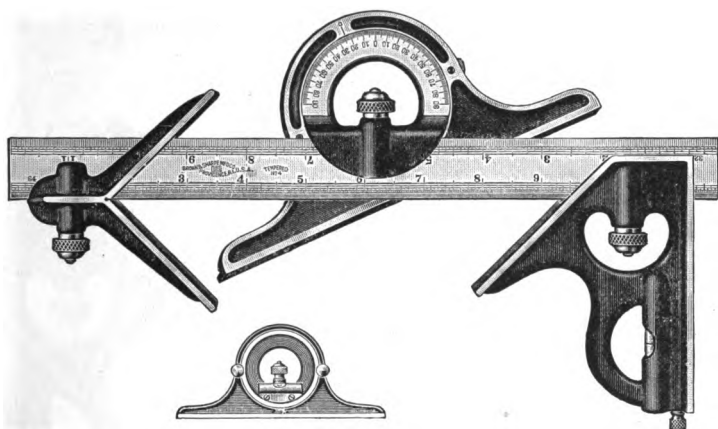
Blades on Nos. 413 and 415 have No. 4 graduation. For List of Graduations, see page 60.

Blades on Nos. 421 and 423 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Combination Sets

ENGLISH, METRIC OR ENGLISH AND METRIC



Reverse Side of Head, showing Level

With Hardened Square and Centre Heads			With Soft Heads		
No.	Size	Price	No.	Size	Price
425 English	9 inch	\$7.50	426 English	9 inch	\$6.60
	12 "	7.80		12 "	6.90
	18 "	9.00		18 "	8.10
	24 "	9.60		24 "	8.70
429 Metric	20 c/m	\$7.50	430 Metric	20 c/m	\$6.60
	30 "	7.80		30 "	6.90
	50 "	9.00		50 "	8.10
	60 "	9.60		60 "	8.70
433 English and Metric	20 c/m	\$7.50	434 English and Metric	20 c/m	\$6.60
	30 "	7.80		30 "	6.90
	50 "	9.00		50 "	8.10
	60 "	9.60		60 "	8.70

All blades are tempered.

Blades on Nos. 425 and 426 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on Nos. 429 and 430 are graduated as follows: 1st and 3rd corners to millimetres, 2nd and 4th corners to half millimetres.

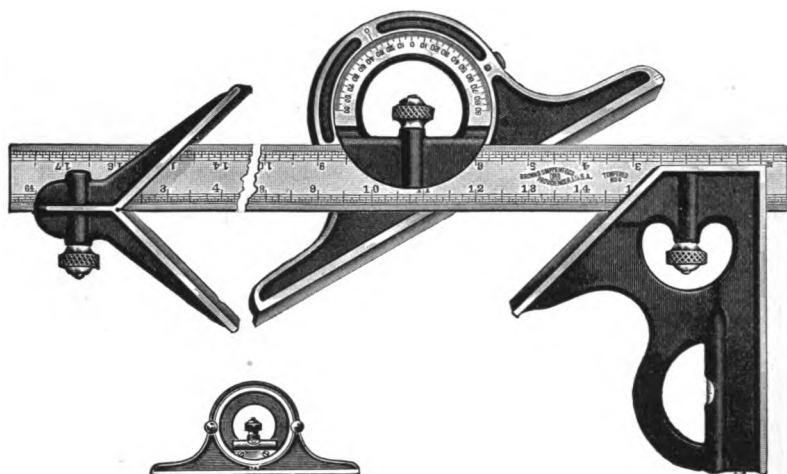
Blades on Nos. 433 and 434 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Combination Sets

Heavy

ENGLISH OR ENGLISH AND METRIC



Reverse Side of Head, showing Level

With Hardened Square and Centre Heads

No.	Size	Price
427 English	18 inch 24 "	\$13.20 14.40
435 English and Metric	50 c/m 60 "	\$13.20 14.40

With Soft Heads

No.	Size	Price
428 English	18 inch 24 "	\$12.60 13.20
436 English and Metric	50 c/m 60 "	\$12.60 13.20

All blades are tempered.

Blades on Nos. 427 and 428 have No. 4 graduation. For List of Graduations, see page 60.

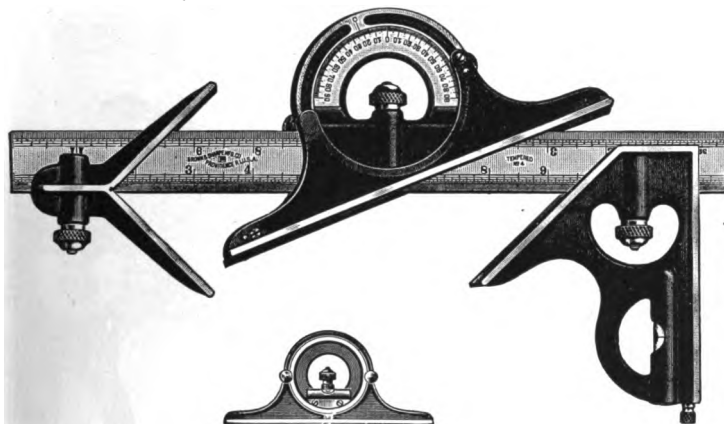
Blades on Nos. 435 and 436 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Combination Sets

With Reversible Protractor Head

ENGLISH, METRIC OR ENGLISH AND METRIC



Reverse Side of Head, showing Level

With Hardened Square and Centre Heads			With Soft Heads		
No.	Size	Price	No.	Size	Price
438 English	9 inch	\$8.70	439 English	9 inch	\$7.20
	12 "	9.00		12 "	7.50
	18 "	10.20		18 "	8.70
	24 "	10.80		24 "	9.60
442 Metric	20 c/m	\$8.70	443 Metric	20 c/m	\$7.20
	30 "	9.00		30 "	7.50
	50 "	10.20		50 "	8.70
	60 "	10.80		60 "	9.60
446 English and Metric	20 c/m	\$8.70	447 English and Metric	20 c/m	\$7.20
	30 "	9.00		30 "	7.50
	50 "	10.20		50 "	8.70
	60 "	10.80		60 "	9.60

All blades are tempered.

Blades on Nos. 438 and 439 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on Nos. 442 and 443 are graduated as follows: 1st and 3rd corners to millimetres, 2nd and 4th corners to half millimetres.

Blades on Nos. 446 and 447 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

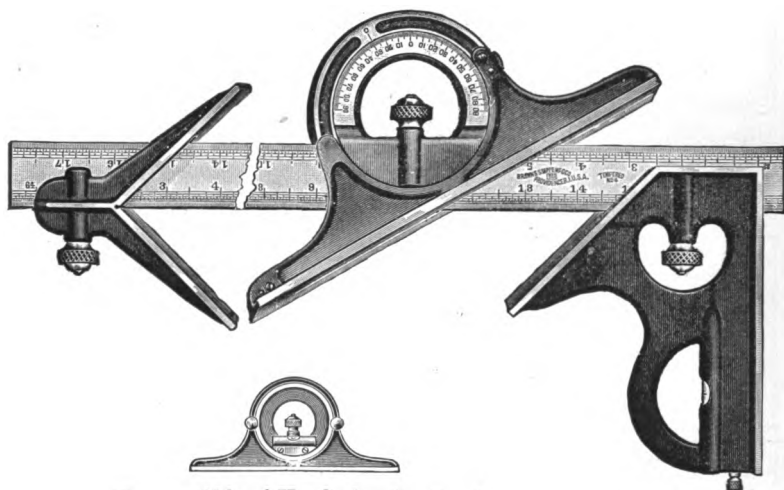
Packed one in a box.

B & S Combination Sets

Heavy

With Reversible Protractor Head

ENGLISH OR ENGLISH AND METRIC



Reverse Side of Head, showing Level

With Hardened Square and Centre Heads

With Soft Heads

No.	Size	Price	No.	Size	Price
440 English	18 inch 24 "	\$14.10 15.60	441 English	18 inch 24 "	\$13.20 14.40
448 English and Metric	50 c/m 60 "	\$14.10 15.60	449 English and Metric	50 c/m 60 "	\$13.20 14.40

All blades are tempered.

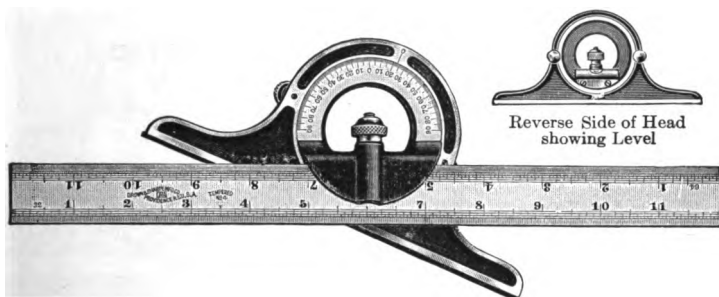
Blades on Nos. 440 and 441 have No. 4 graduation. For List of Graduations, see page 60.

Blades on Nos. 448 and 449 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Protractors

ENGLISH, METRIC OR ENGLISH AND METRIC



No.	Size	Price
450 English	9 inch	\$4.50
	12 "	5.10
	18 "	6.00
	24 "	6.90
452 Metric	20 centimetres	\$4.50
	30 "	5.10
	50 "	6.00
	60 "	6.90
454 English and Metric	20 centimetres	\$4.50
	30 "	5.10
	50 "	6.00
	60 "	6.90

All blades are tempered.

Blades on No. 450 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on No. 452 are graduated as follows: 1st and 3rd corners to millimetres, 2nd and 4th corners to half millimetres.

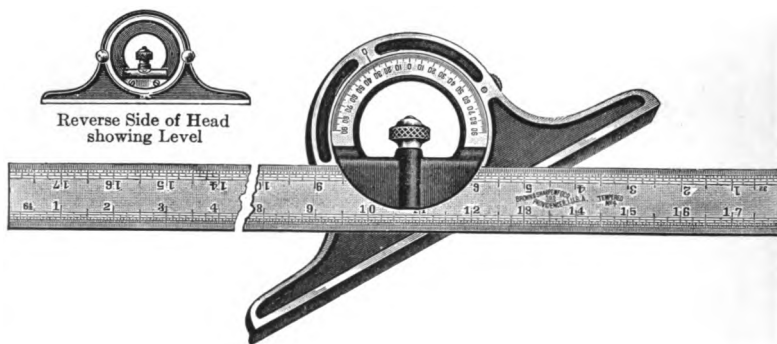
Blades on No. 454 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Protractors

Heavy

ENGLISH OR ENGLISH AND METRIC



No.	Size	Price
451 English	18 inch 24 "	\$8.40 9.60
455 English and Metric	50 centimetres 60 "	\$8.40 9.60

All blades are tempered.

Blades on No. 451 have No. 4 graduation. For List of Graduations, see page 60.

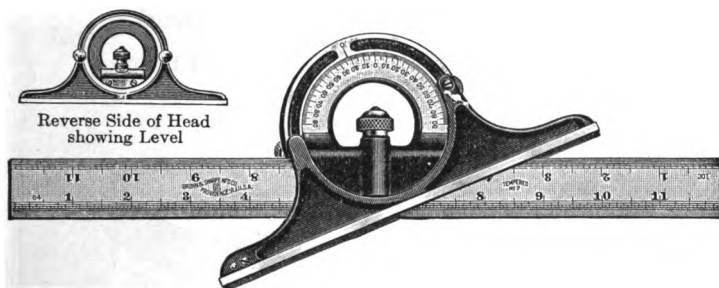
Blades on No. 455 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

B & S Protractor

With Reversible Protractor Head

ENGLISH, METRIC OR ENGLISH AND METRIC



No.	Size	Price
456 English	9 inch	\$5.40
	12 "	5.70
	18 "	6.90
	24 "	7.50
458 Metric	20 centimetres	\$5.40
	30 "	5.70
	50 "	6.90
	60 "	7.50
460 English and Metric	20 centimetres	\$5.40
	30 "	5.70
	50 "	6.90
	60 "	7.50

All blades are tempered.

Blades on No. 456 have No. 4 or 7 graduation. For List of Graduations, see page 60.

Blades on No. 458 are graduated as follows: 1st and 3rd corners to millimetres, 2nd and 4th corners to half millimetres.

Blades on No. 460 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

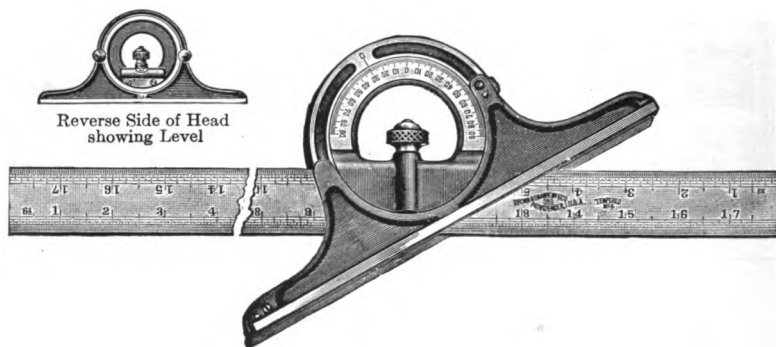
Packed one in a box.

B & S Protractors

Heavy

With Reversible Protractor Head

ENGLISH OR ENGLISH AND METRIC



No.	Size	Price
457	18 inch	\$9.00
English	24 "	10.20
461	50 centimetres	\$9.00
English and Metric	60 "	10.20

All blades are tempered.

Blades on No. 457 have No. 4 graduation. For List of Graduations, see page 60.

Blades on No. 461 are graduated as follows: 1st corner to millimetres, 2nd corner to 32nds of an inch, 3rd corner to half millimetres, and the 4th corner to 64ths of an inch.

Packed one in a box.

Separate Parts

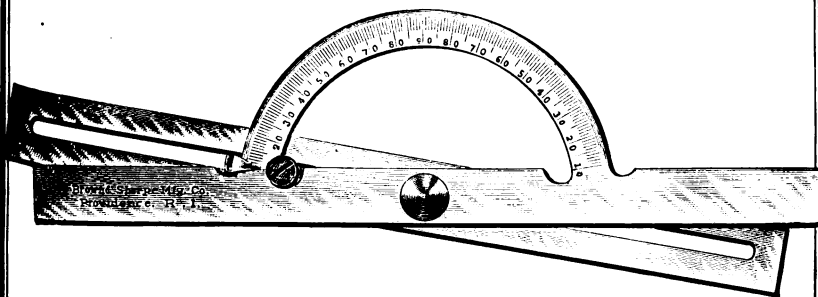
FOR COMBINATION SQUARES, COMBINATION SETS
AND PROTRACTORS

492

Size	Price of Blades	Price of Square Heads		Price of Centre Heads		Price of Protractors	
	Tem- pered	Soft	Hard- ened	Soft	Hard- ened	Plain	Reversible
4" or 10 c/m	\$0.90	\$1.20	\$1.50				
6" or 15 c/m	1.20	1.50	2.10	\$1.20	\$1.50		
9" or 20 c/m	1.50	1.50	2.10	1.50	1.90	\$3.25	\$4.20
12" or 30 c/m	1.90	1.90	2.40	1.50	1.90	3.25	4.20
18" or 50 c/m	3.00	1.90	2.40	1.50	1.90	3.25	4.20
24" or 60 c/m	3.90	1.90	2.40	1.50	1.90	3.25	4.20
18" or 50 c/m Hy.	3.90	2.70	3.50	2.40	2.70	4.50	5.10
24" or 60 c/m Hy.	5.40	2.70	3.50	2.40	2.70	4.50	5.10

Scribers 20c. each
Level Glasses 20c. each
Level Glasses and setting same 30c. each

Bevel Protractor No. 492

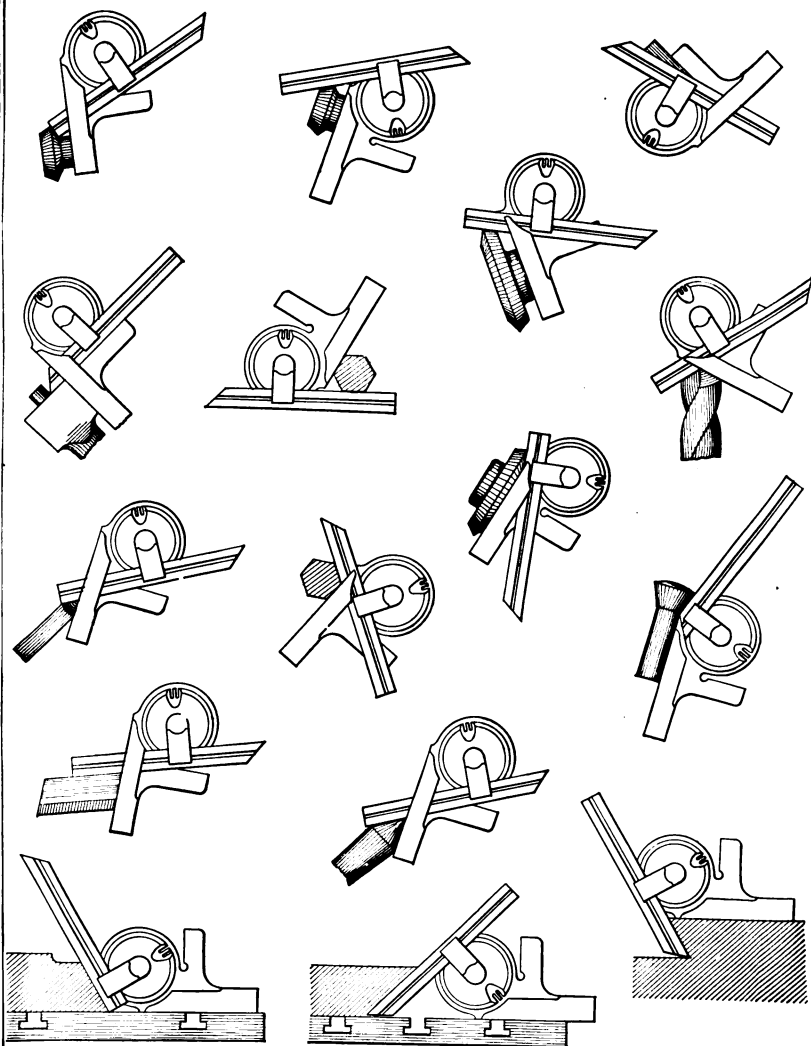


The half-circle is divided into degrees

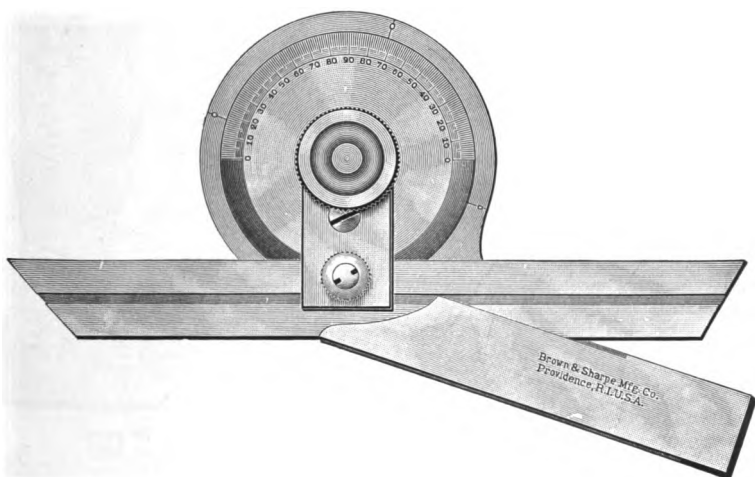
Number	Length of Sliding Arm, Inches	Price
492	6 10	\$10.00 10.50

Packed one in a box.

Different Uses of the Bevel Protractor



Improved Bevel Protractor No. 493



Protractor with 6" blade	Price, \$10.20	In Leatherette Case, \$11.45
Protractor with 12" blade	Price, \$11.40	In Leatherette Case, \$12.90
Protractor with both 6" and 12" blades	Price, \$12.00	In Leatherette Case, \$13.50

Adapted for all classes of work where angles are to be laid out or established which do not require such a fine degree of accuracy as is possible with a Protractor having a Vernier.

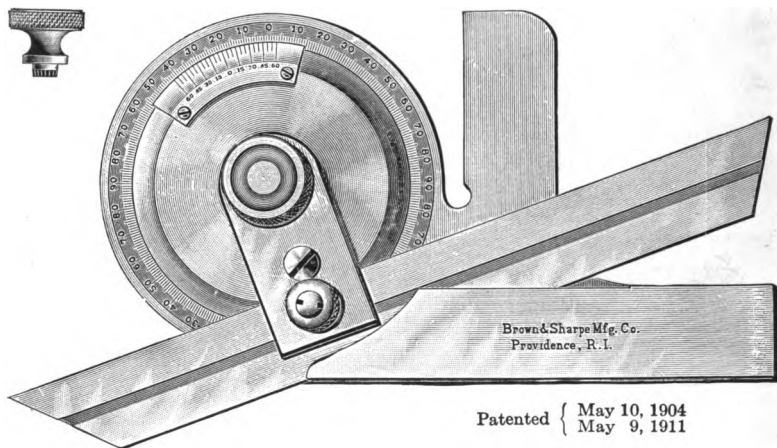
One side of the tool is flat, thus permitting its being laid flat upon the paper or work.

The dial is accurately graduated to degrees over an arc of 180°, reading 0 to 90° from each extremity of the arc. It turns on a large central stud, which is hardened and ground, and can be rigidly clamped in any position after setting.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial.

Packed one in a box.

Improved Universal Bevel Protractor No. 495



Protractor with 6" blade	Price, \$14.50	In Morocco Case, \$16.00
Protractor with 12" blade	Price, \$15.75	In Morocco Case, \$17.75
Protractor with both 6" and 12" blades }	Price, \$16.75	In Morocco Case, \$18.75

Protractor No. 495 is well adapted for all classes of work where angles are to be laid out or established.

One side of the tool is flat, thus permitting its being laid flat upon the paper or work.

The dial is accurately graduated to degrees the entire circle. The swivel turns on a large central stud, which is hardened and ground, and can be rigidly clamped by a thumb nut.

The line of graduations is below the surface, protecting them from wear.

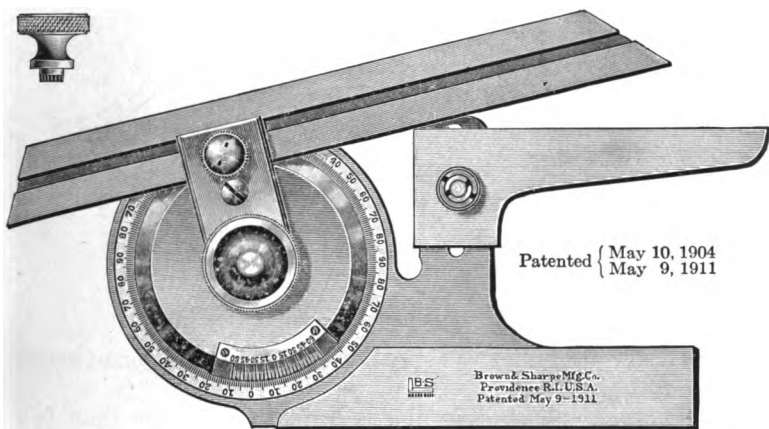
The Vernier adds materially to the use of the Protractor in obtaining fine measurements. It reads to 5 minutes or 1-12 of a degree.

By means of a small thumb pinion furnished as an attachment, extremely fine adjustments can be secured.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial.

Packed one in a box.

Improved Universal Bevel Protractor No. 496



WITH ACUTE ANGLE ATTACHMENT

Protractor with 6" blade	Price, \$17.50	In Morocco Case, \$19.00
Protractor with 12" blade	Price, \$18.50	In Morocco Case, \$20.50
Protractor with both 6" } and 12" blades }	Price, \$19.50	In Morocco Case, \$21.50

The Improved Universal Bevel Protractor with Acute Angle Attachment is designed for all classes of work where angles are to be laid out and, with the attachment, extremely small angles can be easily and quickly established. Alignments are correct, and workmanship throughout the best.

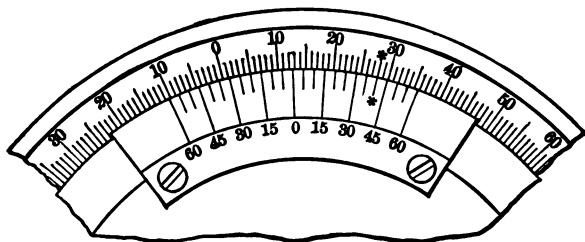
One side of the tool is flat, thus permitting its being laid flat upon the paper or work. The dial is accurately graduated to degrees the entire circle, the graduated surface being depressed, thus protecting the graduations from wear.

A Vernier, which reads to 5 minutes or 1-12 of a degree, adds materially to the fineness to which angles can be laid out. By means of a small thumb screw furnished as an attachment, extremely fine adjustments can be made.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial.

Packed one in a box.

Improved Universal Bevel Protractor



Method of Reading the Vernier

THE Vernier indicates every five minutes (5'), or one-twelfth of a degree.

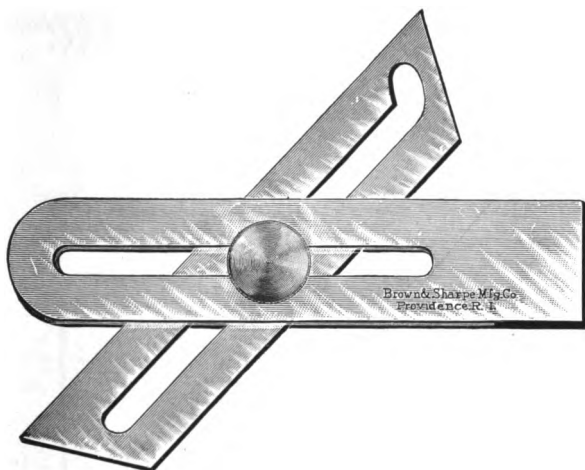
Each space upon the Vernier is 5 minutes shorter than two spaces on the true scale.

When the line marked 0 on the Vernier coincides with the line marked 0 on the true scale, the edges of the base and blade are parallel. When the swivel head is moved so the line on the Vernier next to 0 coincides with the line next but one to 0 on the true scale, the included angle of the base and blade has been changed one-twelfth of a degree, or 5 minutes.

To Read the Protractor Setting. Read off directly from the true scale the number of whole degrees between 0 and the 0 of the Vernier scale. Then count, in the same direction, the number of spaces from the 0 of the Vernier scale to a line that coincides with a line on the true scale; multiplying this number by 5, the product will be the number of minutes to be added to the whole number of degrees.

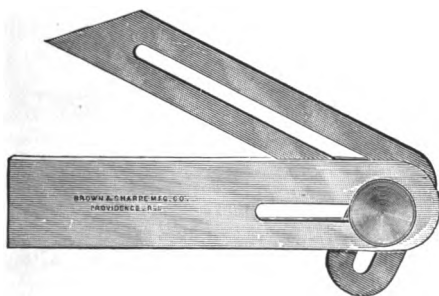
For example: As the Vernier is shown in the cut it has moved 12 whole degrees to the right of the 0 upon the true scale, and the 8th line on the Vernier coincides with a line upon the true scale as indicated by *. Multiplying 8 by 5, the product, 40, is the number of minutes to be added to the whole number of degrees, thus indicating a setting of 12 degrees and 40 minutes ($12^{\circ} 40'$).

Universal Bevels No. 498



No.	Length of Head and Tongue, Inches	Width of Head and Tongue, Inches	Price
498	3 1 1-4	5-8 1-4	\$2.40 2.40

Improved Universal Bevel No. 499



Price, \$2.00

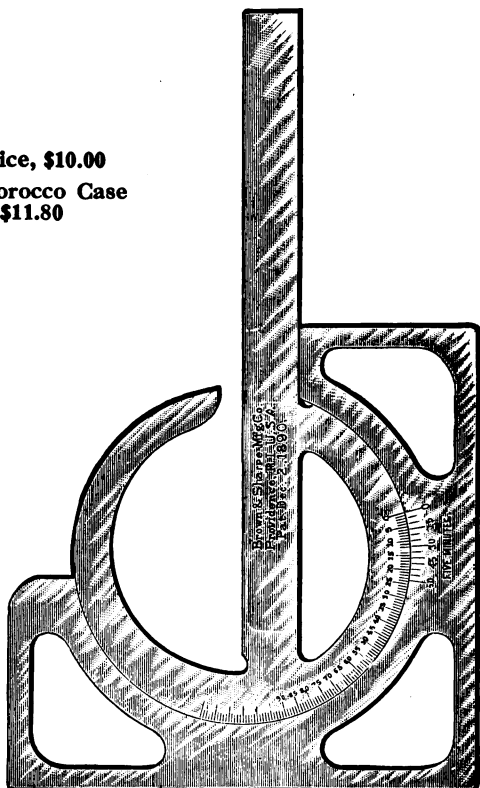
The above cut represents an Improved Universal Bevel, 3" long, with an offset blade that admits of the measurement of all angles.

The case is solid on the top for 1 1-2" from the square end.

Each of the above packed one in a box.

Draughtsmen's Protractor No. 510

Price, \$10.00
In Morocco Case
\$11.80



Cut about one-third size

Can be quickly set to any angle used either side up and on either of the two outside edges of the frame. It can be used to advantage in dividing a circle, transferring angles or laying off a given angle, without resetting, on either side of a line.

The Vernier reads to five minutes.

This Protractor forms a convenient extension of a T square and frequently takes the place of 45° and 60° angles.

Packed one in a box.

Tables for Use with Draughtsmen's Protractor

Table for Dividing Circles or Laying out Geometrical Figures

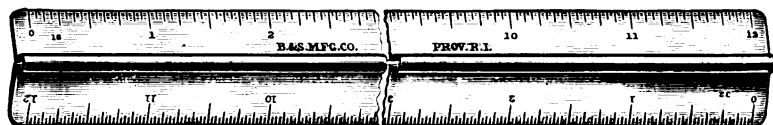
No. of Sides	Included Angle	Angles at Centre of Circles	Angles for Sides of Figures
3	120°	30°	30°
4	90°	45°	45°
5	72°	18°-54°	36°-72°
6	60°	30°	30°
8	45°	45°	22° 30'
10	36°	54°-18°	18°-54°
12	30°	60°	15°-45°
14	25° 43'	64° 17'-38° 34'-12° 51'	12° 51'-38° 34'-64° 17'
16	22° 30'	67° 30'-45°	11° 15'-33° 45'
18	20°	70°-50°-30°-10°	10°-30°-50°-70°
20	18°	72°-54°	9°-27°-45°
24	15°	75°-60°-45°	7° 30'-22° 30'-37° 30'

Tapers per Foot and Corresponding Angles

Taper Per Foot, Inches	Included Angle	Angle with Centre Line	Taper Per Foot, Inches	Included Angle	Angle with Centre Line
1-8	0°-36'	0°-18'	1	4°-46'	2°-23'
1-4	1 -12	0 -36	1 1-2	7 -09	3 -35
5-16	1 -30	0 -45	1 3-4	8 -20	4 -10
3-8	1 -47	0 -54	2	9 -31	4 -46
7-16	2 -05	1 -02	2 1-2	11 -54	5 -57
1-2	2 -23	1 -12	3	14 -15	7 -08
3-4	3 -35	1 -47	3 1-2	16 -36	8 -18
15-16	4 -28	2 -14	4	18 -55	9 -28

Improved Scales for Draughtsmen

No. 517



These Scales are of steel, nickel plated, and are of a design combining lightness with strength. A 12" scale weighs but 2 1-2 oz. The underside of the scale is beveled, thus bringing the graduated side close to the work, a distinct advantage in laying out work accurately. Each scale has two similar graduations, each complete in itself, thus eliminating the confusion caused by many dissimilar graduations.

No.	Length, Inches	Graduation	Price
517	12	On one edge 1-16", other edge 1-32"	\$1.50
	12	On one edge 1-32", other edge 1-64"	1.50
	12	On one edge 1-64", other edge 1-100"	1.50
	6	On one edge 1-16", other edge 1-32"	1.20
	6	On one edge 1-32", other edge 1-64"	1.20
	6	On one edge 1-64", other edge 1-100"	1.20

SPECIAL SCALES MADE TO ORDER

Prices on Application

Packed one in a box.

Draughtsmen's Steel Straight Edges No. 525

525

B & S Mfg. Co. Prov. R. I.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
525	15	1 1-4	3-64	\$1.80
	18	1 1-2	3-64	2.10
	24	1 1-2	3-64	2.40
	30	1 3-4	3-64	3.00
	36	2	1-16	3.90
	42	2 1-4	1-16	5.10
	48	2 1-2	1-16	7.20
	60	2 3-4	5-64	9.60
	72	2 3-4	5-64	12.00

526

Beveled Steel Straight Edges No. 526

B & S Mfg. Co. Prov. R. I.

The beveled edge is 1-16" thick.

Beveled on one edge only.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
526	12	1 3-8	3-16	\$2.00
	18	1 3-4	3-16	3.25
	24	2	1-4	4.50
	36	3	1-4	7.20
	48	3	1-4	12.00
	60	3 1-8	9-32	18.00
	72	3 1-8	9-32	24.00

Each of the above packed one in a package.

Hardened Steel Straight Edges No. 527



Our Straight Edges are like the tongues of our Hardened Steel Try Squares and are hardened on the edges only. Made from the best quality of steel and with every care taken to insure their being straight.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
527	3 7-8	15-16	1-16	\$0.70
	5 1-2	1 1-8	5-64	1.20
	7	1 3-8	5-64	1.50
	10 3-4	1 3-4	5-64	2.40
	13 3-4	2 1-16	5-64	3.60
	17	2 7-16	5-64	4.20
	20	2 7-8	7-64	5.40
	27	3	7-64	8.40
	33	3 1-4	1-8	10.80
	39	3 5-8	1-8	14.40

Standard Steel Straight Edges No. 528



Differ from Straight Edges No. 527 only in their dimensions and in not being hardened.

No.	Length, Inches	Width, Inches	Approximate Thickness, Inches	Price
528	6	1	5-64	\$0.70
	9	1 1-16	5-64	1.10
	12	1 1-4	5-64	1.50
	18	1 1-2	3-32	2.40
	24	2	3-32	3.30
	36	2 1-2	7-64	6.00
	48	3	7-64	9.60
	60	3	1-8	14.40
	72	3	1-8	19.20

Each of the above packed one in a package.

Toolmakers' Knife-Edge Straight Edges No. 530

For work that requires extreme accuracy. They are made from the best quality of steel, and every care is taken to insure their being straight and true.

530

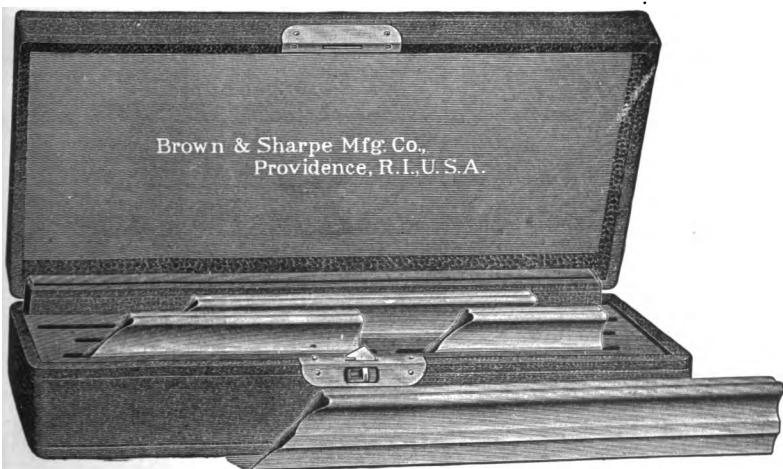
No.	Length, Inches	Width, Inches	Price
530	2 1-4	13-16	\$3.30
	3 1-4	13-16	4.50
	4 1-2	13-16	5.70
	6 1-4	13-16	8.40

531

The above Straight Edges are furnished in cloth-covered cases.

Test Bar, in cloth-covered case	Price, \$4.80
Leather case for complete set	1.25
Cloth-covered case for test bar .....	.25
Cloth-covered case for single straight edge .....	.20

Toolmakers' Knife-Edge Straight Edges, Set No. 531

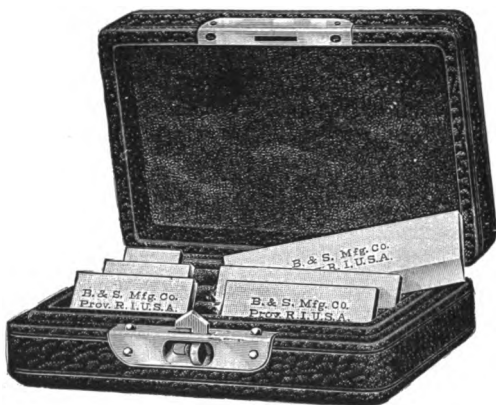


Price, Complete in Leather Case, \$25.20

Consists of Glass Test Bar and 4 Straight Edges, 1 each—2 1-4", 3 1-4", 4 1-2" and 6 1-4" long.

Each of the above packed one in a box.

Narrow-Edge Straight Edges, Set No. 536



Price, Set Complete in Morocco Case,

\$3.00

Similar in design to our Beveled Steel Straight Edges, listed on page 95, but are made of tempered steel, being 5-64ths of an inch thick and 19-32nds of an inch wide.

The set comprises six lengths, 1-2", 3-4", 1", 1 1-4", 1 1-2" and 2".

They are useful in testing flanged and ball-bearing washers and are particularly adapted for toolmakers' use for testing surfaces where it would be impossible to use a regular straight edge.

Packed one set in a box.

Hardened Cast Steel Try Squares No. 540



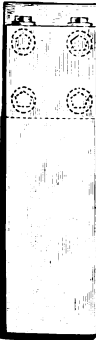
B.&S. Mfg. Co. Prov. R. I.

The length of blade as given is from the inner edge of the beam to end of blade.

Substantial Wooden Cases for protecting the Squares when not in use can be furnished when desired. For prices, see following list.

No.	Length of Blade, Inches	Length of Beam, Inches	Price	Price of Case
540	1 1-2	1 9-16	\$3.60	\$0.80
	3	2 7-16	4.50	.80
	4 1-2	3 9-16	6.90	.80
	6	4 3-8	9.00	.80
	9	5 5-8	13.50	.80
	12	7 1-8	18.00	1.25
	15	8 3-16	30.00	1.50
	18	10 1-4	34.50	2.50

Improved Hardened Cast Steel Try Squares No. 541



B.&S. Mfg. Co. Prov. R. I. Pat. June 7, 1904.

The improvement in making large Try Squares consists in securing the blade to the beam by means of screws, whereby they are made more permanent and accurate and can be more readily and economically repaired.

The length of blade, as given, is from the inner edge of beam to end of blade.

The screws should be adjusted only at our works.

Price includes a substantial Wooden Case.

No.	Length of Blade, Inches	Length of Beam, Inches	Price
541	24	13 1-8	\$45.00
	30	16 1-4	60.00
	36	19 1-2	75.00

Each of the above packed one in a box.



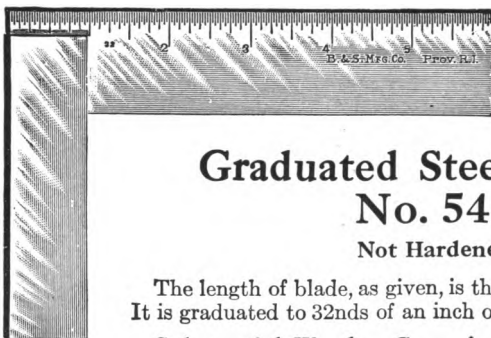
Steel Squares with Beveled Edges No. 542

Hardened

Designed for all classes of work where the requirements are most exacting. The blades are beveled on both edges of each side, furnishing practically a line contact with the work.

The beams and edges of the blade are hardened and accurately ground for parallelism.

No.	Length of Blade, Inches	Length of Beam, Inches	Price
542	1 1-2	1 9-16	\$4.20
	3	2 7-16	5.70
	4 1-2	3 9-16	8.40
	6	4 3-8	11.40



Graduated Steel Squares No. 544

Not Hardened

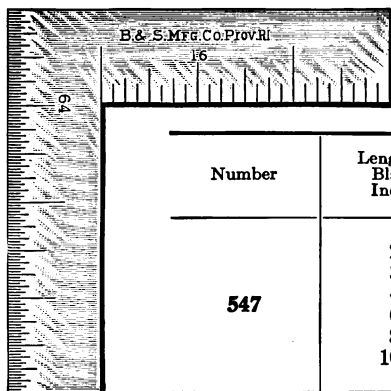
The length of blade, as given, is the extreme length over all. It is graduated to 32nds of an inch on one corner of each side.

Substantial Wooden Cases for protecting the Squares when not in use, can be furnished when desired, for the 9" and 12". For prices see following list.

No.	Length of Blade, Inches	Length of Beam, Inches	Price	Price of Case
544	3	2	\$3.90	
	4	2 9-16	5.70	
	6	3 3-4	7.50	
	9	5	12.00	\$0.80
	12	6 1-16	14.40	1.25

Each of the above packed one in a box.

Thin Steel Squares No. 547



Graduated

Number	Length of Blade, Inches	Width of Blade, Inches	Price
547	2	1-2	\$2.10
	3	5-8	2.70
	4	3-4	3.60
	6	1	5.10
	8	1 1-8	6.60
	10	1 1-4	8.10

The 2" and 3" are graduated to 16ths and 64ths of an inch on one inside and one outside corner of one side and similarly to 32nds and 64ths on the other.

The 4", 6", 8" and 10" are graduated on both sides to 16ths and 32nds of an inch.

Packed as follows: 2" to 6" inc., six in a box; 8" and 10", one in a package.



Steel Square for Millwrights No. 550

Price, \$14.40

Designed to meet the wants of those desiring a more accurate tool than the ordinary carpenter's square.

Long blade, 24" long, 2" wide
Short blade, 18" long, 1 1-2" wide

Both blades are 5-32" thick at the corner where they unite, and taper down to 1-16" at their ends. One outside and inside corner graduated to 8ths. One outside and inside corner graduated to 16ths, excepting one inch on end graduated to 64ths and the second inch from end graduated to 32nds.

Both sides have similar graduations.

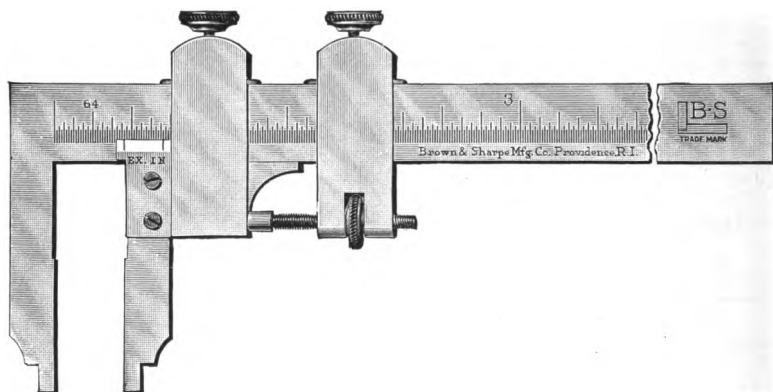
Packed one in a package.

547

550

Caliper Squares Nos. 560, 561 and 562

ENGLISH, METRIC OR ENGLISH AND METRIC MEASURE



The Caliper Squares, listed on the following page, are convenient for a large class of work where extreme accuracy is not required, and are also valuable for use in duplicating work when the number of pieces will not warrant the expense of fixed gauges.

One jaw, or measuring point, is fixed, being an integral part of the bar, the other is carried by a sliding head that may be adjusted along the bar.

Quick adjustment of the points is secured by releasing both clamping screws and sliding the adjustable head the required distance along the bar.

Fine adjustment of the points may then be made by clamping the thumb screw at the right and turning the knurled nut on the horizontal screw.

The Caliper Squares take inside as well as outside measurements and have hardened jaws.

Caliper Squares No. 560

No.	Size, Inches	Length of Jaws, Inches	Width of Jaws Closed, Inches	Price without Adjusting Screw	Price with Adjusting Screw	Price of Leather Case
560	4	1 1-2	1-4	\$9.00	\$10.20	\$1.20
	6	2	1-4	10.80	13.20	1.20
	9	3 1-4	3-8	15.00	17.40	1.50

Graduated on one side to 64ths, on the other to 100ths of an inch.

Caliper Squares No. 561

METRIC MEASURE

No.	Size, m/m	Length of Jaws, m/m	Width of Jaws Closed, m/m	Price without Adjusting Screw	Price with Adjusting Screw	Price of Leather Case
561	100	38	6	\$9.00	\$10.20	\$1.20
	150	50	6	10.80	13.20	1.20
	250	80	10	15.00	17.40	1.50

Graduated on one side to half millimetres, on the other to millimetres.

Caliper Squares No. 562

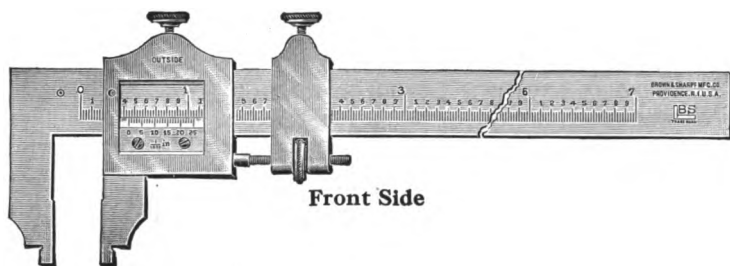
ENGLISH AND METRIC MEASURE

No.	Size, Inches	Length of Jaws, Inches	Width of Jaws Closed, Inches	Price without Adjusting Screw	Price with Adjusting Screw	Price of Leather Case
562	4	1 1-2	1-4	\$9.00	\$10.20	\$1.20
	6	2	1-4	10.80	13.20	1.20
	9	3 1-4	3-8	15.00	17.40	1.50

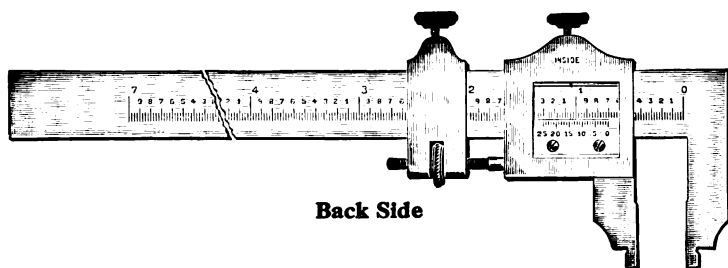
Graduated on one side to half millimetres, on the other to 100ths of an inch.

Each of the above packed one in a box.

Vernier Calipers



Front Side



Back Side

The Vernier Calipers listed on the opposite page, take inside as well as outside measurements.

They are graduated to read on one side for outside, and on the other for inside measurements. This new feature enables the user to read either outside or inside measurements direct from the caliper without calculation.

The jaws are hardened and ground. Points are placed on the bars and slides, so that dividers can be set to transfer distances.

An explanation of the Vernier is sent with each Caliper.

Furnished in cases unless otherwise ordered.

A 1-4" Standard Internal Cylindrical Gauge is furnished, when desired, for testing the accuracy of the adjustment of the Caliper. Price of Standard, \$3.75 extra.

Vernier Calipers No. 570

Graduated on both front and back to read, by means of a Vernier, to thousandths of an inch.

No.	Size, Inches	Length of Jaws, Inches	Width of Jaws Closed, Inches	Price with Case	Price without Case
570	6	1 1-4	1-4	\$25.50	\$24.00
	12	2 1-4	3-10	32.75	30.00
	24	2 1-4	3-10	46.50	42.00
	36	2 3-4	1-2	72.00	72.00

Vernier Calipers No. 571

METRIC MEASURE

Differ from Vernier Calipers No. 570 only in reading to Metric measure. Graduated on both front and back to read, by means of a Vernier, to 50ths of a millimetre.

No.	Size, m/m	Length of Jaws, m/m	Width of Jaws Closed, m/m	Price with Case	Price without Case
571	150	31	6	\$25.50	\$24.00
	300	57	6	32.75	30.00
	600	57	6	46.50	42.00
	900	69	12	72.00	72.00

Vernier Calipers No. 572

ENGLISH AND METRIC MEASURE

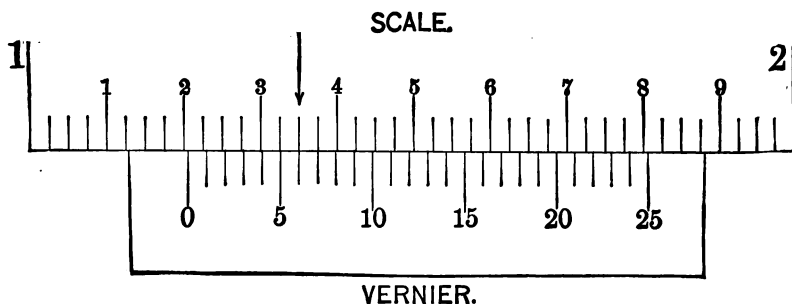
Differ from Vernier Calipers No. 571 only in reading to both English and Metric measure. They are graduated to read to thousandths of an inch on one side and 50ths of a millimetre on the other.

No.	Size, Inches	Length of Jaws, Inches	Width of Jaws Closed, Inches	Price with Case	Price without Case
572	6	1 1-4	1-4	\$25.50	\$24.00
	12	2 1-4	3-10	32.75	30.00
	24	2 1-4	3-10	46.50	42.00
	36	2 3-4	1-2	72.00	72.00

All Vernier Calipers listed on this page are furnished in cases, unless otherwise ordered.

Each of the above packed one in a box.

Description of the Vernier and Its Use



ON the bar of the instrument is a line of inches numbered 0, 1, 2, etc., each inch being divided into ten parts and each tenth into four parts, making forty divisions to the inch. On the sliding jaw is a line of division (called a Vernier, from the inventor's name) of twenty-five parts, numbered 0, 5, 10, 15, 20, 25. The twenty-five parts on the Vernier correspond, in extreme length, with twenty-four parts, or twenty-four fortieths of an inch on the bar; consequently each division on the Vernier is smaller than each division on the bar by one-thousandth part of an inch. If the sliding jaw of the Caliper is pushed up to the other so that the line marked 0 on the Vernier corresponds with that marked 0 on the bar, then the two next lines to the right will differ from each other by one-thousandth of an inch, and so the difference will continue to increase, one-thousandth of an inch for each division, till they again correspond at the line marked 25 on the Vernier. To read the distance the Caliper is open, commence by noticing how many inches, tenths, and parts of tenths the zero point on the Vernier has been moved from the zero point on the bar. Now count upon the Vernier the number of divisions, until one is

found which coincides with the one on the bar, which will be the number of thousandths to be added to the distance read off on the bar. The best way of expressing the value of the divisions on the bar is to call the tenths one hundred thousandths (.100) and the fourths of tenths, or fortieths, twenty-five thousandths (.025).

For example:

As the Vernier is shown in the cut it has been moved to the right one and two-tenths inches, or 1.200", as indicated by the bar; and the sixth line on the Vernier coincides with a line on the bar, thus making six thousandths (.006) of an inch to be added to the reading from the scale, which would make the total reading one and two hundred and six thousandths inches (1.206").

On Brown & Sharpe Vernier Calipers where both the inside and outside measurements are taken from the same side of the Caliper, the inside measurements are obtained as follows:

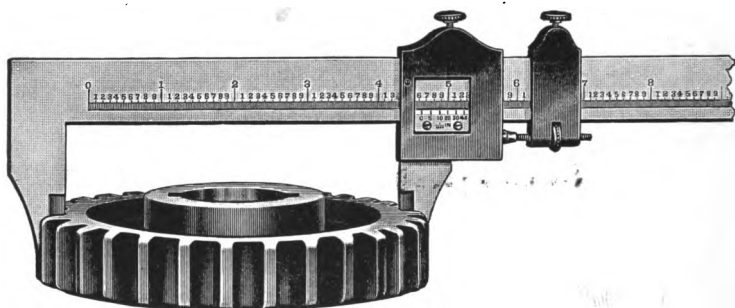
With the 6" Vernier, two and one-half tenths or two hundred and fifty thousandths (.250) of an inch, and with the 12" and 24" Verniers, three-tenths or three hundred thousandths (.300) of an inch, and with the 36", one-half (.500) of an inch should be added to the apparent reading on the Vernier side for the space occupied by the caliper points. With a Vernier Caliper reading to metric measure, add 6 m/m to the apparent reading of the 150 m/m, 300 m/m and 600 m/m Calipers, and 12 m/m to the 900 m/m Caliper. When the other side of instrument is used, no deduction is necessary, as there are two lines, one indicating inside and the other outside measurements.

With combination English *and* Metric Verniers, the caliper points are of the same width as those of the plain English. In making inside Metric measurements, therefore, the *Metric Equivalents of the above additions* should be added.

Depth of Gear Tooth Vernier Caliper No. 573

For Determining Accurately the Depth of Gear Teeth

ENGLISH OR METRIC MEASURE



Price, in Finished Wooden Case, \$32.75

Price, without case, \$30.00

Furnished in case unless otherwise ordered

Measuring the bottom diameter of gears provides an accurate check on the cutting operation and insures the duplication of any desired standard.

This tool, therefore, is found especially valuable in the Automobile Shop for measuring automobile transmission gears where it is impossible to use our regular Vernier Calipers on account of the thickness of the jaws.

Being very similar to our 12" Vernier Caliper with the exception of the shape of the jaws, this tool can also be used for outside measurements. Graduated on one side only.

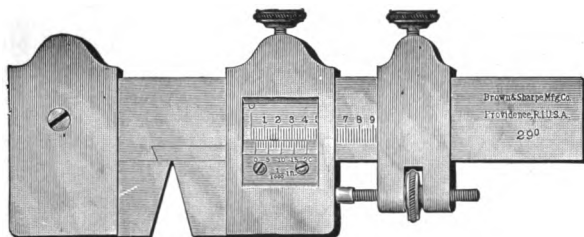
Depth of jaws, 1 7/8". Width of measuring surface, 1-32".

An explanation of the Vernier is sent with each Caliper.

Packed one in a box.

Thread Tool Verniers No. 576

ENGLISH AND METRIC



60° Thread Tool Vernier, in Morocco Case, \$26.50

29° Thread Tool Vernier, in Morocco Case, \$26.50

55° Thread Tool Vernier, in Morocco Case, \$26.50

Price, without Case, \$25.00

Furnished in case unless otherwise ordered

To the manufacturer looking for an extremely accurate instrument for measuring thread tools of different pitches, this tool is recommended. It does away with the large number of gauges formerly kept on hand.

When in use, the sliding jaw is set for the width of point of tool of the required pitch. The thread tool is then ground so that the point bottoms on the hardened steel strip inserted in the blade and the sides rest against the jaws of the tool.

The jaws or measuring surfaces are carefully hardened and ground, the angle being carefully tested for accuracy. The Vernier reads to thousandths of an inch on one side of the tool, and to 50ths of a millimetre on the other. The tool is graduated for only one inch and twenty-five millimetres on the respective sides.

Packed one in a box.

Gear-Tooth Verniers No. 580

20 diametral to 2 diametral pitch

Price, in Morocco Case, \$42.75

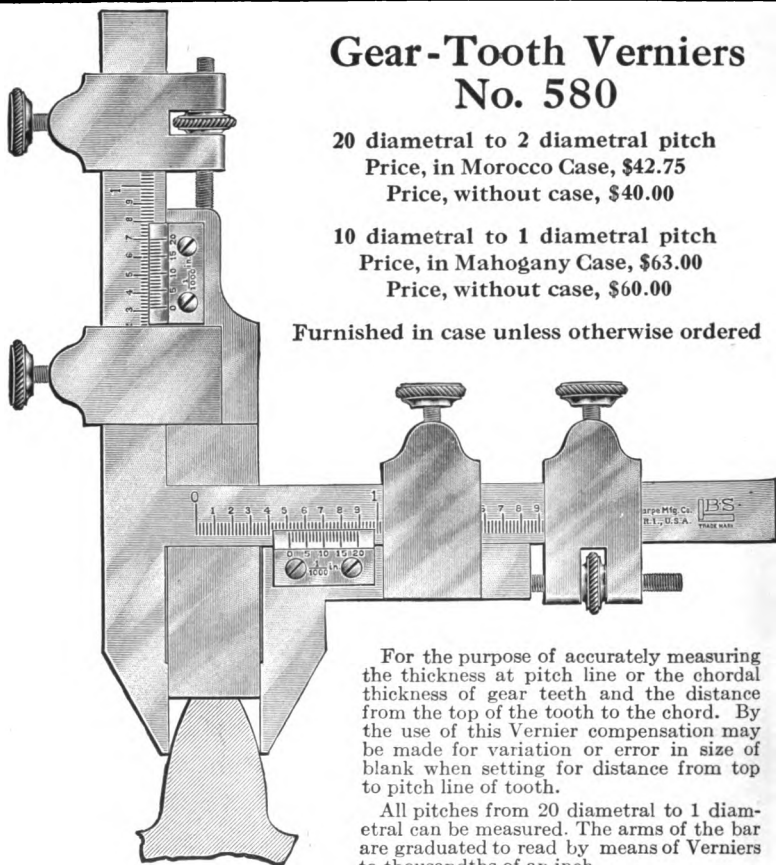
Price, without case, \$40.00

10 diametral to 1 diametral pitch

Price, in Mahogany Case, \$63.00

Price, without case, \$60.00

Furnished in case unless otherwise ordered



For the purpose of accurately measuring the thickness at pitch line or the chordal thickness of gear teeth and the distance from the top of the tooth to the chord. By the use of this Vernier compensation may be made for variation or error in size of blank when setting for distance from top to pitch line of tooth.

All pitches from 20 diametral to 1 diametral can be measured. The arms of the bar are graduated to read by means of Verniers to thousandths of an inch.

The thickness of the tooth at pitch line and the addendum are measured respectively by a jaw and tongue which move upon these arms.

Both the sliding jaw and tongue are provided with adjusting screws.

Gear-Tooth Verniers No. 581

METRIC MEASURE

1 1-4 m/m to 12 m/m Module

Price, in Morocco Case, \$42.75

Price, without case, \$40.00

2 1-2 m/m to 25 m/m Module

Price, in Mahogany Case, \$63.00

Price, without case, \$60.00

Furnished in case unless otherwise ordered

Differ from Gear-Tooth Verniers No. 580 only in being graduated to read to 50ths of a millimetre.

Each of the above packed one in a box.

Vernier Height Gauges No. 585

ENGLISH, METRIC OR ENGLISH AND METRIC MEASURE

10" Gauge

Price, in Morocco Case, \$39.00

Price, without Case, \$36.00

18" Gauge

Price, in Wooden Case, \$94.00

Price, without Case, \$90.00

Furnished in Case unless otherwise ordered

10" Gauge

The Height Gauge is used for obtaining the height of projections from plane surfaces, for the location of bushings in jigs, etc.

The bar is graduated to read by means of a Vernier to thousandths of an inch or 50ths of a millimetre.

The base is 3" long, 1 1/4" wide, and 3-4" high, allows the gauge to stand upright, and is rounded on the end for use close to projections. The base extends beyond the bar somewhat to insure stability. A combination marker and extension for the movable jaw is furnished.

English Measure. On one side, between the jaws, this gauge reads from 0 to 10", and on the other, outside the jaws, from 1 1/8" to 10" by thousandths of an inch.

Metric Measure. Also graduated to read on one side from 0 to 25 c/m between the jaws, and on the other from 28 m/m to 25 c/m outside the jaws, by 50ths of a millimetre.

English and Metric Measure. Also graduated to read on one side from 1 1/8" to 10" by thousandths of an inch, and on the other, from 28 m/m to 25 c/m by 50ths of a millimetre. Both these measurements are outside the jaws.

18" Gauge

Differs from the 10" Gauge in its range and in the size of the base. The bar also has a jappanned groove along its centre to reduce the weight of the tool somewhat. The base is 5" long, 2" wide, and 7-8" high. Measurements are taken only on the outside of the jaws of this tool.

English Measure. Reads from 1 1/2" to 18" by thousandths of an inch.

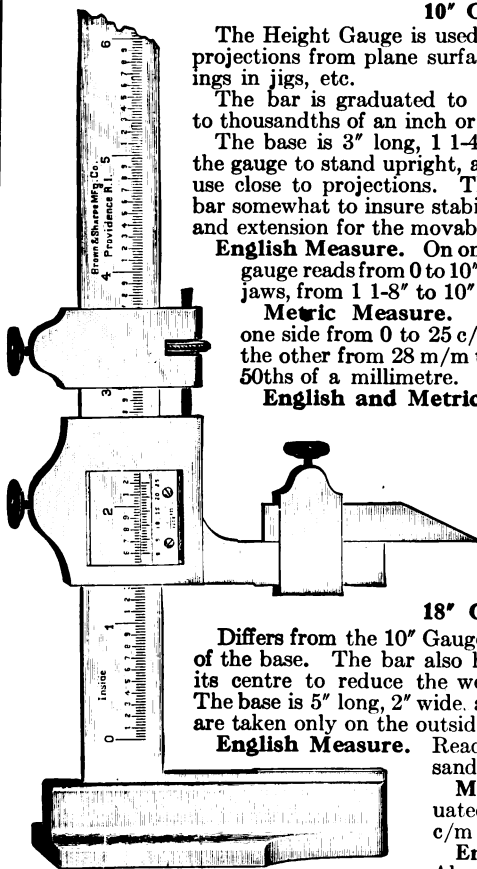
Metric Measure. Also graduated to read from 40 m/m to 46 c/m by 50ths of a millimetre.

English and Metric Measure.

Also graduated to read on one side

from 1 1/2" to 18" by thousandths of an inch, and on the other, from 40 m/m to 46 c/m by 50ths of a millimetre.

Packed one in a box.

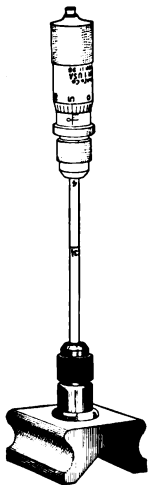


Height Gauge Attachment No. 598



For Use with Inside Micrometers Nos. 260 and 261

Price, \$2.25



These cuts show a base designed for use in connection with the Inside Micrometers, thus making a reliable Height Gauge, and the method of using the same.

The measuring rod is inserted upwards through the under side of the base and the clamping fingers; and by turning the knurled nut, is held firmly in an upright position. The micrometer is then adjusted and clamped to the upper end of the rod.

The base has a V-shaped groove in the bottom, which adapts the tool for use in cylindrical work.

Packed one in a box.

Vernier Depth Gauge No. 600

**ENGLISH, METRIC OR ENGLISH
AND METRIC MEASURE**

Price, in Morocco Case, \$16.00

Price, without Case, \$14.50

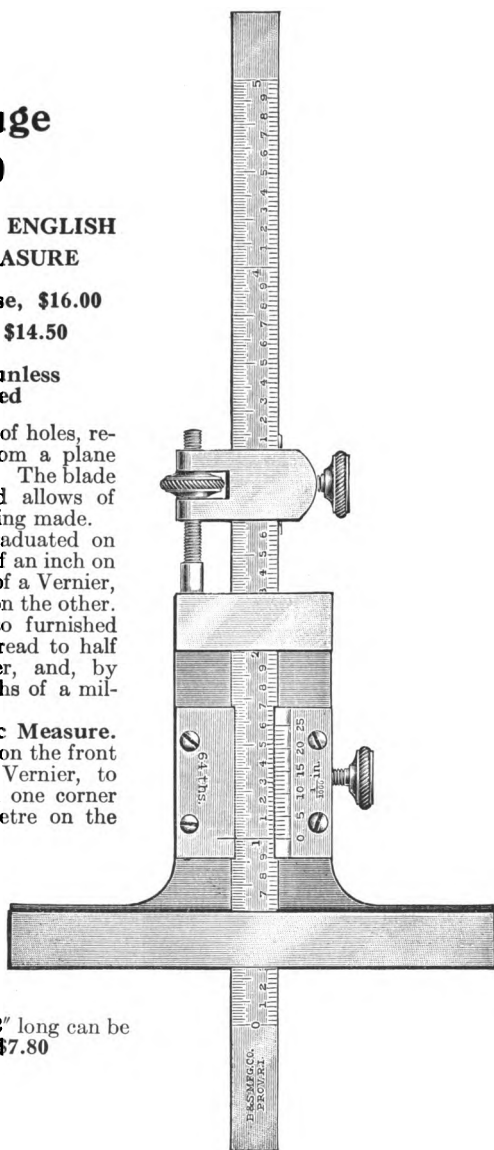
**Furnished in Case unless
otherwise ordered**

For obtaining the depth of holes, recesses in dies, distance from a plane surface to a projection, etc. The blade is 6" long, 1-4" wide and allows of measurements to 3 1-2" being made.

English Measure. Graduated on the front to read to 64ths of an inch on one corner and, by means of a Vernier, to thousandths of an inch on the other.

Metric Measure. Also furnished graduated on the front to read to half millimetres on one corner, and, by means of a Vernier, to 50ths of a millimetre on the other.

English and Metric Measure. Also furnished graduated on the front to read, by means of a Vernier, to thousandths of an inch on one corner and to 50ths of a millimetre on the other.



**Note: An extra blade, 12" long can be
furnished. Price, \$7.80**

Packed one in a box.

Micrometer Depth Gauges No. 605

ENGLISH OR METRIC MEASURE

2" Base

Price, \$7.75 Morocco Case \$1.00

4" Base

Price, \$8.50 Morocco Case \$1.25

4 1-2" Base

Price, \$9.75 Morocco Case, \$3.00

The screw in the 2"- and 4"-base Gauges has a movement of 1-2 inch. The graduations are of such a form and depth that the clamping fingers, at the end of gauge, spring in, allowing the 1-2" adjustments of the rod to be quickly and positively made.

The base is about 7-16" thick, and, together with the point of the rod, is hardened.

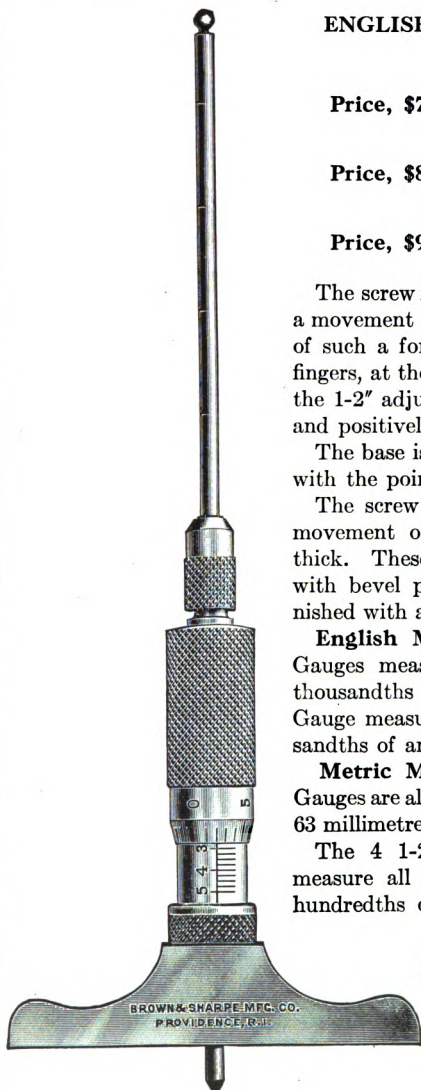
The screw of the 4 1-2"-base Gauge has a movement of 1". The base is about 9-16" thick. These Gauges are regularly furnished with bevel point as shown, but can be furnished with a flat point if desired.

English Measure. The 2"- and 4"-base Gauges measure all distances to 2 1-2" by thousandths of an inch. The 4 1-2"-base Gauge measures all distances to 12" by thousandths of an inch.

Metric Measure. The 2"- and 4"-base Gauges are also made to measure all distances to 63 millimetres by hundredths of a millimetre.

The 4 1-2"-base Gauge is also made to measure all distances to 300 millimetres by hundredths of a millimetre.

Packed one in a box.



Universal Depth Gauge No. 610

ENGLISH OR METRIC MEASURE

610

Price, \$5.00

Patented June 21, 1904

A spiral spring in the barrel forces the blade against the bottom of the hole or recess. A friction clutch, free to move under pressure of the spiral spring, holds the blade without clamping. The blade can be swiveled completely around without disturbing the setting. A **Clamp Nut** at the top of the barrel clamps the blade securely in position when desired.

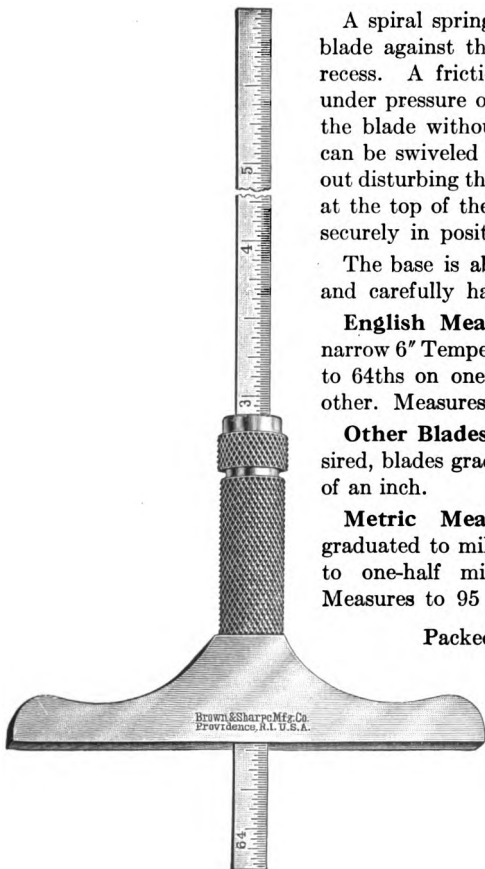
The base is about 3" long, 7-16" wide, and carefully hardened and ground.

English Measure. The Blade is a narrow 6" Tempered Steel Rule graduated to 64ths on one side and 100ths on the other. Measures to 3 1-8" in depth.

Other Blades. We furnish, when desired, blades graduated to 32ds and 64ths of an inch.

Metric Measure. Also furnished graduated to millimetres on one side and to one-half millimetres on the other. Measures to 95 millimetres in depth.

Packed one in a box.



Spring Depth Gauges No. 612

2" Base Price, \$4.00

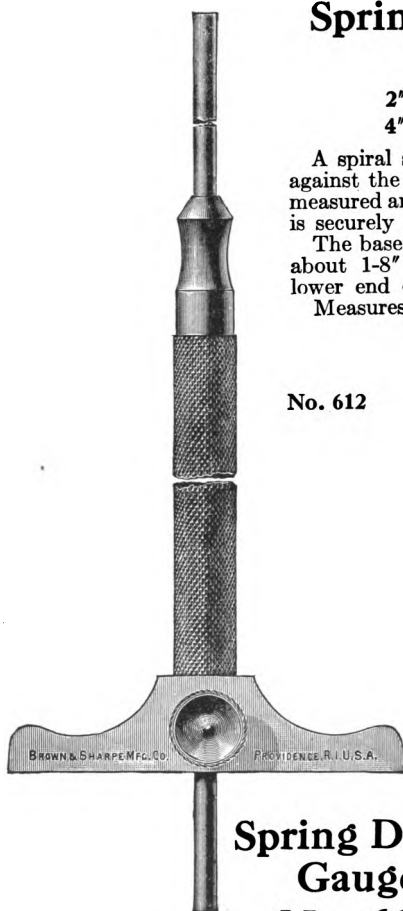
4" Base Price, \$5.00

A spiral spring in the barrel forces the rod against the bottom of the hole or recess to be measured and by use of the clamp screw the rod is securely locked in position.

The base is about 7-16" wide, and the rod about 1-8" in diameter, both the base and lower end of the rod being hardened.

Measures to 3" in depth.

No. 612



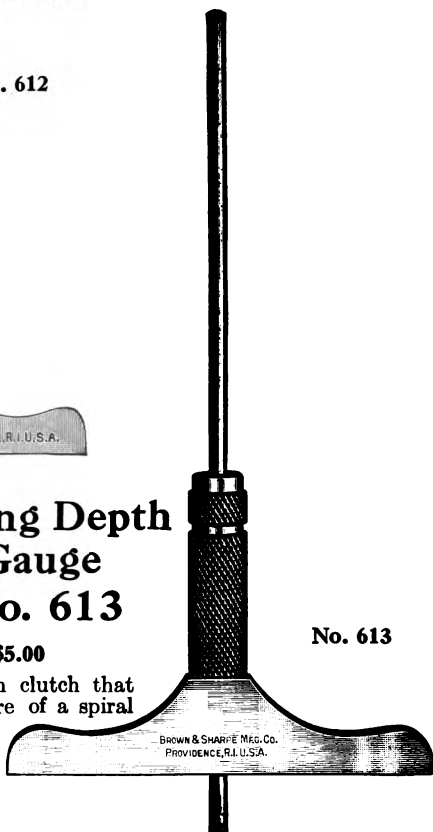
Spring Depth Gauge No. 613

3" Base Price, \$5.00

The rod is held by a friction clutch that is free to move under pressure of a spiral spring and enables approximate settings to be quickly made. Measures to 4" in depth.

Each of the above packed one in a box.

No. 613



6-Inch Rule Depth Gauge No. 615

ENGLISH OR METRIC
MEASURE

Price, \$1.50

The accompanying is a full-sized cut of the head and blade of a 6" Rule Depth Gauge.

The head, made of hardened steel 1-8" thick, is of a form

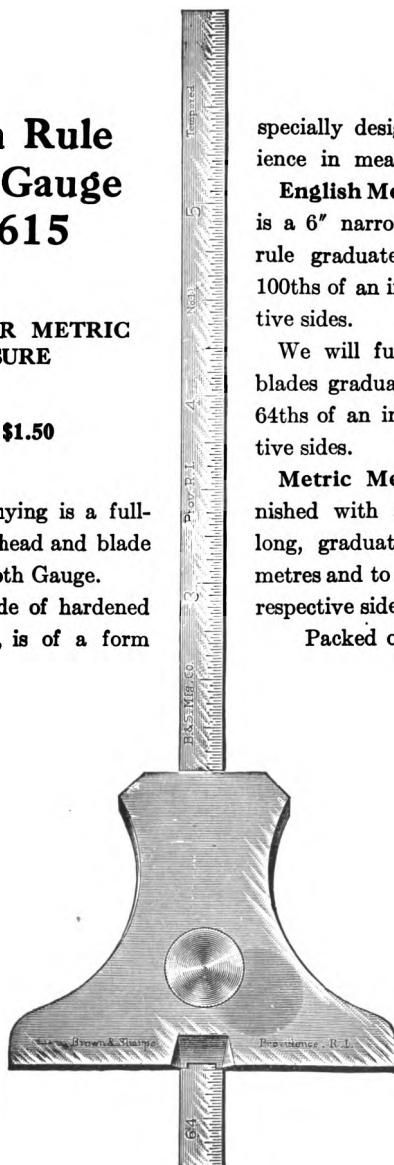
specially designed for convenience in measuring.

English Measure. The blade is a 6" narrow, tempered-steel rule graduated to 64ths and 100ths of an inch on the respective sides.

We will furnish, if desired, blades graduated to 32nds and 64ths of an inch on the respective sides.

Metric Measure. Also furnished with a blade 15 c/m long, graduated to half millimetres and to millimetres on the respective sides.

Packed one in a box.



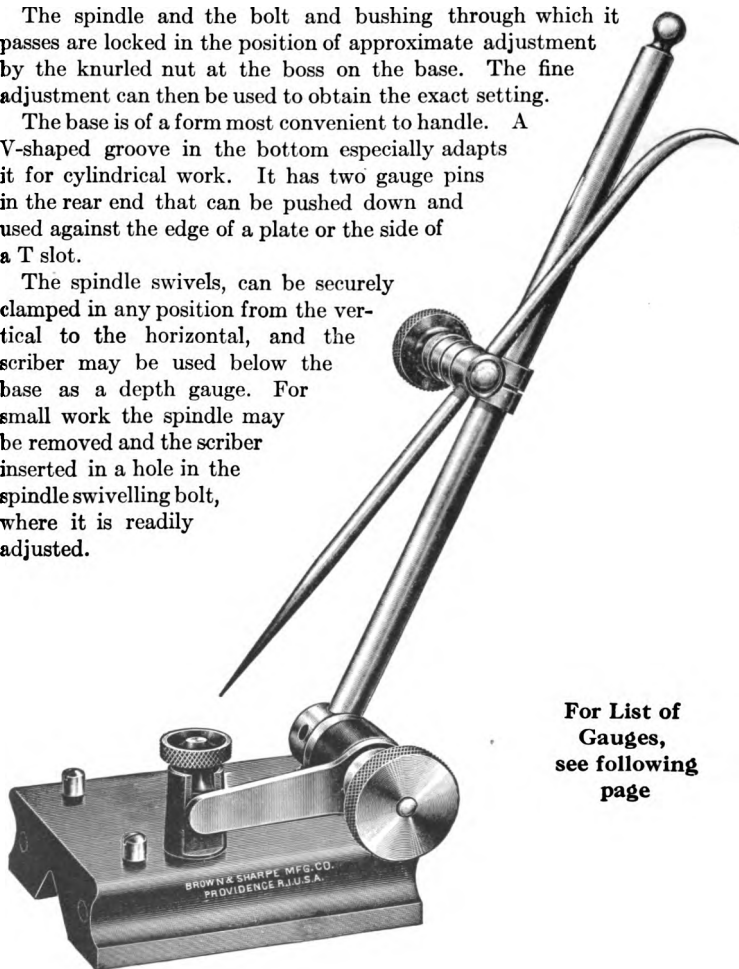
Universal Surface Gauges

OUR line of Surface Gauges has been so designed that a wide range of adjustments can be readily made by means of the knurled adjusting screw.

The spindle and the bolt and bushing through which it passes are locked in the position of approximate adjustment by the knurled nut at the boss on the base. The fine adjustment can then be used to obtain the exact setting.

The base is of a form most convenient to handle. A V-shaped groove in the bottom especially adapts it for cylindrical work. It has two gauge pins in the rear end that can be pushed down and used against the edge of a plate or the side of a T slot.

The spindle swivels, can be securely clamped in any position from the vertical to the horizontal, and the scriber may be used below the base as a depth gauge. For small work the spindle may be removed and the scriber inserted in a hole in the spindle swivelling bolt, where it is readily adjusted.



**For List of
Gauges,
see following
page**

Universal Surface Gauge No. 620

Price, with 4" Spindle, Base Not Hardened \$3.50

Price, with 4" Spindle, Base Hardened 4.10

Size of Base, 2 1-4" x 1 1-2"

Universal Surface Gauge No. 621

Price, with 9" Spindle, Base Not Hardened \$3.50

Price, with 9" and 12" Spindles, Base Not Hardened 4.00

Price, with 9" Spindle, Base Hardened 4.75

Price, with 9" and 12" Spindles, Base Hardened 5.15

Size of Base, 3 1-8" x 2 1-2"

Universal Surface Gauge No. 622

Heavy Base

Price, with 12" Spindle, Base Not Hardened \$4.15

Price, with 12" and 18" Spindles, Base Not Hardened 4.75

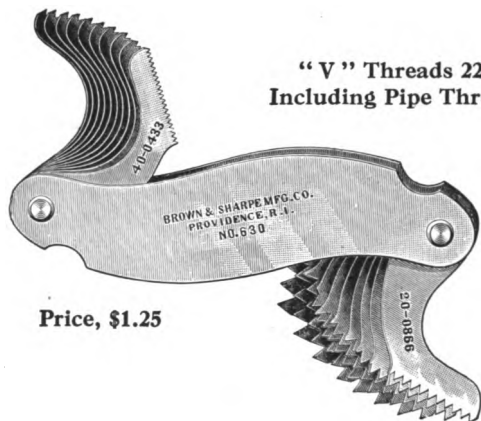
Price, with 12" Spindle, Base Hardened 5.30

Price, with 12" and 18" Spindles, Base Hardened 6.00

Size of Base, 4" x 3 3-8"

Packed one in a box.

Screw Pitch Gauge No. 630



**"V" Threads 22 Pitches
Including Pipe Thread Pitches**

Price, \$1.25

Designed for the threads of nuts as well as of screws and contains the following threads per inch: 9, 10, 11, 11 1-2, 12, 13, 14, 15, 16, 18 and 20 on one end, and 22, 24, 26, 27, 28, 30, 32, 34, 36, 38 and 40 on the other.

The arrangement of blades, hinged on each end of the case, enables the mechanic to quickly select the desired blade and place it in position for use. The number of threads per inch and double the depth of the thread in decimals are stamped on each blade.

There are 22 pitches, including pipe thread, threads per inch, 11 1-2 and 27. The 8 pitch can be determined by using the 16 pitch blade.

Screw Pitch Gauge No. 631

"V" THREADS

24 Pitches

Price, \$1.50

Similar in design to Screw Pitch Gauge No. 630. It contains 24 blades with the following threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2 and 12 on one end, and 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28 and 30 on the other.

Screw Pitch Gauge No. 632

"V" THREADS

30 Pitches

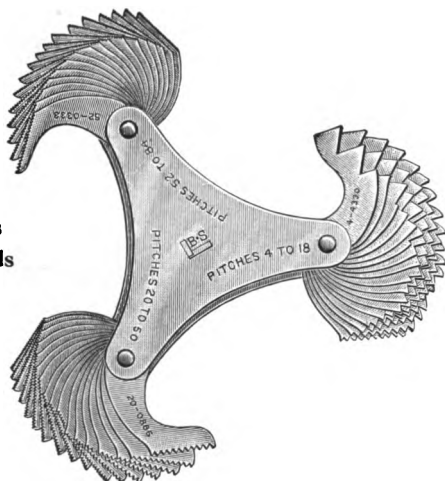
Price, \$1.75

Similar in design to Screw Pitch Gauge No. 630. It contains 30 blades with the following threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2, 12, 13, 14 and 15 on one end and 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40 and 42 on the other.

Each of the above packed one in a box.

Screw Pitch Gauge No. 633

**51 Pitches
"V" Threads**



Price, \$2.75

The triangular form of the frame of this Screw Pitch Gauge permits a compact housing of 51 blades for threads of nuts as well as of screws.

Threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82 and 84.

Screw Pitch Gauge No. 634

For Electricians and Automobile Manufacturers

"V" THREADS

22 Pitches

Price, \$1.25

Similar in design to Screw Pitch Gauge No. 630, shown on preceding page, and is designed especially to meet the requirements of automobile manufacturers, electricians and others using screws with fine V threads.

The Gauge contains 22 blades with the following threads per inch: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50 and 52 on one end, and 54, 56, 58, 60, 62, 64, 66, 68, 70, 72 and 74 on the other.

Screw Pitch Gauge No. 635

U. S. STANDARD THREAD

25 Pitches

Price, \$2.00

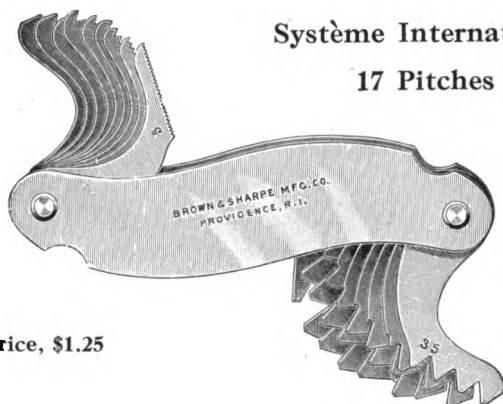
Similar in design to Screw Pitch Gauge No. 630, but without decimals. It contains 26 blades, with the following threads per inch: 2 1-4, 2 3-8, 2 1-2, 2 5-8, 2 3-4, 2 7-8, 3, 3 1-4, 3 1-2, 4, 4 1-2 and 5 on one end, and 5 1-2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18 and 20 on the other. It also contains a blade with a gauge for grinding thread tools.

Packed one in box.

Screw Pitch Gauge No. 636

Système International

17 Pitches



Price, \$1.25

For determining quickly the pitch for screws, nuts, bolts, etc., and is made after the French system of the Society of Encouragement for National Industry. It can be used for inside as well as outside threads. The Gauge contains blades for the following pitches: 1-2, 3-4, 1, 1 1-4, 1 1-2, 1 3-4, 2, 2 1-2, 3, 3 1-2, 4, 4 1-2, 5, 5 1-2, 6, 6 1-2 and 7 millimetres. It also contains a blade with a gauge for grinding thread tools.

Screw Pitch Gauge No. 637

Whitworth Standard

24 Pitches

Price, \$1.50

Similar in design to Screw Pitch Gauge No. 630, but without decimals. Contains 24 blades, with the following threads per inch: 4, 4 1-2, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 16 on one end; 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 40 and 48 on the other.

Screw Pitch Gauge No. 638

Society of Automobile Engineers Standard

7 Pitches

Price, \$1.50

Similar in design to Screw Pitch Gauge No. 630, but without decimals, and contains blades for the following pitches: 12, 14, 16, 18, 20, 24 and 28. It also contains a blade with a gauge for grinding thread tools.

Each of the above packed one in a box.

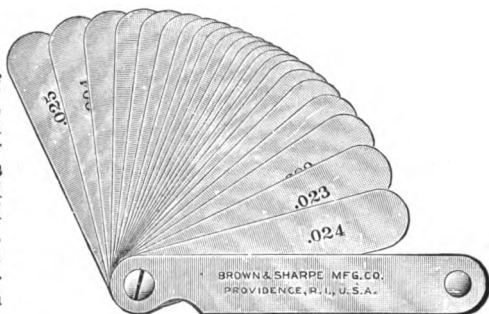
Thickness Gauges Nos. 640, 641, 642, 643 and 644

ENGLISH OR METRIC MEASURE

No. 640, English

Price, \$2.50

This Gauge consists of a set of 22 steel blades, varying in thickness from .004 to .025 of an inch, by thousandths. The blades which are 2 5-16" long and 7-16" wide, may be used singly or in combination, as may be desired. Plain figures, easily read, indicate the thickness of each blade.



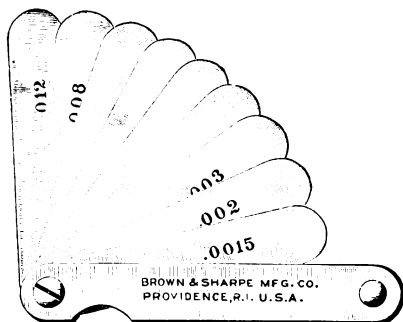
No. 641, Metric

Price, \$2.50

Differs from Thickness Gauge No. 640 in the number of blades, there being 14 steel blades of the following thicknesses: .05, .06, .07, .08, .09, .10, .15, .20, .25, .30, .40, .50, .75 and 1 m/m.

No. 642, English Price, \$1.50

Differs from Thickness Gauge No. 640 in the number of blades, there being 9 steel blades, .0015, .002, .003, .004, .006, .008, .010, .012 and .015 of an inch in thickness.



No. 643, Metric

Price, \$1.50

Differs from Thickness Gauge No. 641 in the number of blades, there being nine steel blades of the following thicknesses: .04, .05, .08, .10, .15, .20, .25, .30, and .35 m/m.

No. 644, English

Price, \$1.50

Differs from Thickness Gauge No. 640 in the number, length and width of the blades. There are nine blades, 3" long and 1-2" wide of the following thicknesses: .0015, .002, .003, .004, .006, .008, .010, .012 and .015 of an inch.

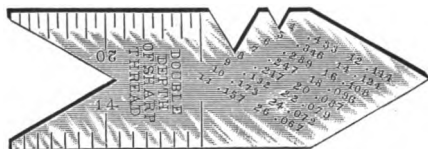
Each of the above packed one in a box.

Centre Gauges Nos. 650, 651 and 652

AND GAUGES FOR

Grinding and Setting Screw-Cutting Tools

With Table for Determining the Size of Tap Drills for 60° V Threads



Full Size

U. S. Standard, 60°

No. 650, Price, 35 cents

Tempered, Price, 50 cents

Whitworth or English Standard, 55°

No. 651, Price, 35 cents

Tempered, Price, 50 cents

Metric, 60°

No. 652, Price, 35 cents

Tempered, Price, 50 cents

The angles used on these gauges are 60° for the U. S. Standard and Metric Gauges and 55° for the Whitworth or English Standard. The four divisions, 14, 20, 24 and 32 parts to the inch, are useful in measuring the number of threads to the inch. The following parts to the inch can be determined by them, viz.: 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16, 20, 24, 28 and 32.

The metric gauge is graduated to read to millimetres and half millimetres. When so graduated the table for determining the size of tap drills is omitted.

The table on the gauge (see full-size cut) is used for determining the size of tap drills for sharp 60° V threads, and shows in thousandths of an inch the double depth of thread of tap and screws of the pitches most commonly used. This table is made up by dividing 1.732, the double depth of thread of a screw that is 1 pitch, by the number of threads of the various pitches shown.

As the double depth of thread represents the difference in the diameter of a tap and a tap drill, to obtain the diameter of a tap drill of any desired pitch it is necessary only to subtract the decimal showing the double depth of thread of that pitch from the diameter of the tap. For example, if the tap is 4 pitch, sharp V thread, and one inch diameter, subtract .433, the decimal showing the double depth of thread of this pitch in the table, from one, and the result, .567 of an inch, is the size of the tap drill, which would allow a sharp thread in the hole. Allowance is to be made for the extent to which it is desired the threads should be flattened. It is not practicable to tap a perfectly sharp thread.

Each of the above packed 12 in a box.

Standard End Measuring Rods No. 655 and 656

With Spherical Ends

Made of steel, hardened on the ends and accurately ground, so that the ends are sections of true spheres having diameters equal to those of the length of the rods. These Rods can be used for measuring rings, cylinders, etc., setting calipers, comparing gauges or work of like character and are especially useful for measuring parallel surfaces.

The Rods from 3" to 6" are 3-8" in diameter, and larger than 6", 1-2" in diameter.

No. 655, English

Length, Inches	Price	Length, Inches	Price
3	\$1.75	10	\$3.50
4	2.00	11	3.75
5	2.25	12	4.00
6	2.50	13	4.25
7	2.75	14	4.50
8	3.00	15	4.75
9	3.25	16	5.00

No. 656, Metric

Length, m/m	Price	Length, m/m	Price
75	\$1.75	250	\$3.50
100	2.00	275	3.75
125	2.25	300	4.00
150	2.50	325	4.25
175	2.75	350	4.50
200	3.00	375	4.75
225	3.25	400	5.00

All intermediate sizes, varying by 16ths, are carried in stock and will be furnished at the price of the next larger size given in the list.

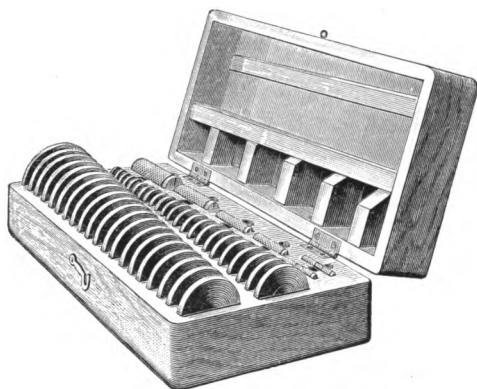
Each of the above packed one in a package.



655

656

Standard Reference Disks



Price per Set, \$65.00

When a gauge or caliper has been long in use, the question arises as to whether or not the wear of constant use has impaired its accuracy.

The Standard Reference Disks are for reference sizes in shop practice. They are generally used without handles. With handles, however, they may be used in place of Standard Cylindrical Gauges, but are not recommended for constant use as substitutes for them, being designed to serve principally as reference, not as working gauges. These Disks are hardened, ground and accurately lapped to size; the widths of the measuring surfaces are suitably proportioned to the size of the disk.

English Measure. They will be furnished singly of any desired size, but are usually furnished in sets consisting of 45 disks, varying by 16ths from 1-4 inch to 3 inches, and 6 handles. Each complete set is neatly arranged in a substantial case.

Metric Measure. Metric Disks are also carried in stock in sizes from 6 m/m to 50 m/m, varying by 2 m/m; and 55 m/m to 100 m/m, varying by 5 m/m.

Special Sizes made to order.

Packed one set in a box.

Standard Reference Disks

No. 657, English

657

658

Size, Inches	Price	Size, Inches	Price	Size, Inches	Price
*1-4	\$1.50	1 3-16	\$1.10	2 1-8	\$1.65
*5-16	1.50	1 1-4	1.10	2 3-16	1.65
3-8	.90	1 5-16	1.25	2 1-4	1.65
7-16	.90	1 3-8	1.25	2 5-16	1.80
1-2	1.00	1 7-16	1.25	2 3-8	1.80
9-16	1.00	1 1-2	1.25	2 7-16	1.80
5-8	1.00	1 9-16	1.40	2 1-2	1.80
11-16	1.00	1 5-8	1.40	2 9-16	1.95
3-4	1.05	1 11-16	1.40	2 5-8	1.95
13-16	1.05	1 3-4	1.40	2 11-16	1.95
7-8	1.05	1 13-16	1.55	2 3-4	2.10
15-16	1.05	1 7-8	1.55	2 13-16	2.10
1	1.10	1 15-16	1.55	2 7-8	2.25
1 1-16	1.10	2	1.55	2 15-16	2.25
1 1-8	1.10	2 1-16	1.65	3	2.25

No. 658, Metric

Size, m/m	Price	Size, m/m	Price	Size, m/m	Price
*6	\$1.50	28	\$1.10	50	\$1.55
*8	1.50	30	1.10	55	1.65
10	.90	32	1.10	60	1.80
12	1.00	34	1.25	65	1.95
14	1.00	36	1.25	70	2.10
16	1.00	38	1.25	75	2.25
18	1.00	40	1.40	80	2.50
20	1.05	42	1.40	85	2.50
22	1.05	44	1.40	90	2.50
24	1.05	46	1.55	95	2.75
26	1.10	48	1.55	100	2.75

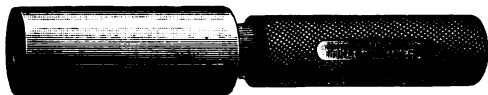
* These sizes are furnished with handles

Price of Handles

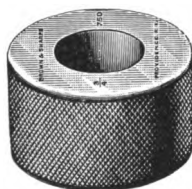
For 3-8" to 9-16" or 10 to 14 m/m Disks	\$0.65
For 5-8" to 1 1-16" or 16 to 26 m/m Disks . . . . .	.75
For 1 1-8" to 1 3-4" or 28 to 44 m/m Disks . . . . .	.80
For 1 13-16" to 3" or 46 to 75 m/m Disks . . . . .	.90
For 80 m/m to 100 m/m Disks . . . . .	.90

Each of the above packed one in a package.

Standard Internal and External Cylindrical Gauges



Internal



External

These Gauges have exceptionally large measuring surfaces and are recommended for the most accurate work. Each Gauge is plainly stamped with its size, both in decimals and common fractions; and a rigid inspection is exacted before Gauges are prepared for shipment.

The Internal Gauges or "Plugs" are convenient for ordinary machine work, as calipers can be set and dimensions transferred more accurately than from a rule; and, for measuring work internally, they can be employed directly without the use of calipers.

The large sizes are unusually light in proportion to their size. They consist of a hardened steel ring on an aluminum centre; and while this construction makes the Gauges very light and convenient, it does not in any way impair their accuracy.

The External Gauges or "Rings" can be used direct for measuring shafts, spindles and work of a similar class.

These Gauges are furnished singly of any desired size. They are also carried in stock, arranged in sets.

English Measure. Sizes from 1-4 inch to 2 inches, varying by 16ths of an inch.

Metric Measure. Carried in stock in sizes from 5 m/m to 50 m/m, varying by 1 m/m; and from 55 m/m to 100 m/m, varying by 5 m/m.

Each complete set is neatly arranged in a substantial case.

Price per Set, \$443.00

For Lists of both Internal and External Cylindrical Gauges, see two following pages.

Standard Internal Cylindrical Gauges

No. 660, English

Size, Inches	Price	Size, Inches	Price	Size, Inches	Price
1-8	\$3.75	1 1-8	\$5.40	2 1-8	\$8.95
3-16	3.75	1 3-16	5.50	2 3-16	9.15
1-4	3.75	1 1-4	5.65	2 1-4	9.30
5-16	3.75	1 5-16	5.80	2 5-16	9.50
3-8	3.90	1 3-8	6.00	2 3-8	9.80
7-16	4.00	1 7-16	6.20	2 7-16	10.15
1-2	4.15	1 1-2	6.40	2 1-2	10.30
9-16	4.25	1 9-16	6.55	2 9-16	10.50
5-8	4.40	1 5-8	6.75	2 5-8	10.70
11-16	4.50	1 11-16	6.95	2 11-16	10.90
3-4	4.65	1 3-4	7.15	2 3-4	11.05
13-16	4.75	1 13-16	7.35	2 13-16	11.25
7-8	4.90	1 7-8	7.50	2 7-8	11.45
15-16	5.00	1 15-16	7.70	2 15-16	11.65
1	5.15	2	7.90	3	11.80
1 1-16	5.25	2 1-16	8.75		

No. 661, Metric

Size, m/m	Price	Size, m/m	Price	Size, m/m	Price
5	\$3.75	29	\$5.40	53	\$8.75
6	3.75	30	5.50	54	8.95
7	3.75	31	5.65	55	9.15
8	3.75	32	5.65	56	9.15
9	3.90	33	5.80	57	9.30
10	3.90	34	6.00	58	9.50
11	4.00	35	6.00	59	9.50
12	4.15	36	6.20	60	9.80
13	4.15	37	6.20	61	10.15
14	4.25	38	6.40	62	10.15
15	4.40	39	6.55	63	10.30
16	4.40	40	6.55	64	10.30
17	4.50	41	6.75	65	10.50
18	4.50	42	6.95	66	10.70
19	4.65	43	6.95	67	10.70
20	4.75	44	7.15	68	10.90
21	4.75	45	7.15	69	11.05
22	4.90	46	7.35	70	11.05
23	5.00	47	7.50	71	11.25
24	5.00	48	7.50	72	11.25
25	5.15	49	7.70	73	11.45
26	5.25	50	7.90	74	11.65
27	5.25	51	7.90	75	11.65
28	5.40	52	8.75	..	....

Standard External Cylindrical Gauges

No. 662, English

662

663

Size, Inches	Price	Size, Inches	Price	Size, Inches	Price
1-8	\$5.55	1 1-8	\$8.45	2 1-8	\$14.05
3-16	5.55	1 3-16	8.75	2 3-16	14.40
1-4	5.55	1 1-4	9.05	2 1-4	14.70
5-16	5.75	1 5-16	9.40	2 5-16	15.00
3-8	5.95	1 3-8	9.70	2 3-8	15.30
7-16	6.15	1 7-16	10.00	2 7-16	15.65
1-2	6.30	1 1-2	10.30	2 1-2	15.95
9-16	6.50	1 9-16	10.65	2 9-16	16.25
5-8	6.70	1 5-8	10.95	2 5-8	16.55
11-16	6.90	1 11-16	11.25	2 11-16	16.90
3-4	7.05	1 3-4	11.55	2 3-4	17.20
13-16	7.25	1 13-16	11.90	2 13-16	17.50
7-8	7.45	1 7-8	12.20	2 7-8	17.80
15-16	7.65	1 15-16	12.50	2 15-16	18.15
1	7.80	2	12.80	3	18.45
1 1-16	8.15	2 1-16	13.75	....	....

No. 663, Metric

Size, m/m	Price	Size, m/m	Price	Size, m/m	Price
5	\$5.55	29	\$8.45	53	\$13.75
6	5.55	30	8.75	54	14.05
7	5.75	31	9.05	55	14.40
8	5.75	32	9.05	56	14.40
9	5.95	33	9.40	57	14.70
10	5.95	34	9.70	58	15.00
11	6.15	35	9.70	59	15.00
12	6.30	36	10.00	60	15.30
13	6.30	37	10.00	61	15.65
14	6.50	38	10.30	62	15.65
15	6.70	39	10.65	63	15.95
16	6.70	40	10.65	64	15.95
17	6.90	41	10.95	65	16.25
18	6.90	42	11.25	66	16.55
19	7.05	43	11.25	67	16.55
20	7.25	44	11.55	68	16.90
21	7.25	45	11.55	69	17.20
22	7.45	46	11.90	70	17.20
23	7.65	47	12.20	71	17.50
24	7.65	48	12.20	72	17.50
25	7.80	49	12.50	73	17.80
26	8.15	50	12.80	74	18.15
27	8.15	51	12.80	75	18.15
28	8.45	52	13.75	..	....

Standard Taper Cylindrical Gauges

Internal and External

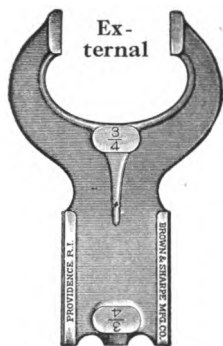


For maintaining standard taper holes in the spindles of machines, collets, etc., as well as standard shanks of arbors, collets, end mills, drills, and tools of a similar character; and are also of service in the sizing of standard taper reamers. These gauges are made in the most careful manner, are carefully hardened and accurately ground and lapped to size. The measuring surfaces are long in proportion to the size of the gauge, thus insuring the maintenance of gauge sizes.

The small ends of the external gauges have adjustable, hardened blocks for indicating the plug depth and reamer depth; one side is plainly stamped "Plug" and the other "Reamer."

Prices on application.

Standard Caliper Gauges

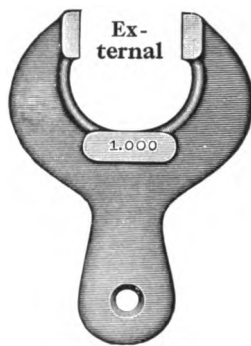


Internal
Style 1

Internal



Style 3



Style 2

The Standard Caliper Gauges are carefully hardened and ground and accurately lapped to size. By their use mistakes in the setting of calipers and variations in measurements by different workmen will in a great measure be avoided. Their form gives lightness and strength, making them preferable to plugs and rings for frequent use. The measuring surfaces are amply large to insure accurate measurements and the maintenance of gauge sizes. As convenient and reliable standard sizes for every-day use in the workshop, they are of great advantage, and their use will contribute to uniformity in the production of the working parts of machinery.

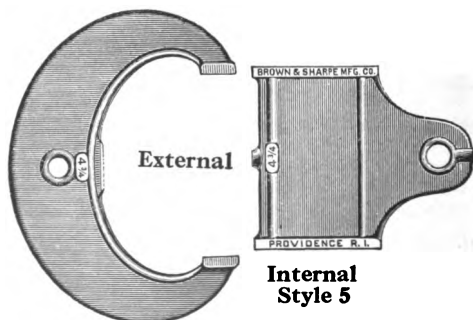
They are furnished with both ends finished, one end for internal and the other for external measurements, in sizes to three inches. They are also furnished in these sizes with one end only finished, either for internal or for external measurements, and provided with handles.

Also furnished in sets, comprising sizes from 1-4 inch to 2 1-2 inches inclusive, varying by 16ths to 2 inches and above 2 inches by 8ths. Each full set is neatly arranged in a substantial case. **Price per Set, \$140.00.**

Standard Caliper Gauges

For convenience in handling, the Standard Caliper Gauges in the larger sizes are made as shown in cut.

For List of Caliper Gauges, see following pages.



Style 4

Internal
Style 5

Standard Caliper Gauges

BOTH ENDS FINISHED

No. 665, English — Style 1

See page 132

665

Size, Inches	Price each	Size, Inches	Price each	Size, Inches	Price each
1-4	\$3.50	1 3-16	\$4.00	2 1-8	\$5.60
5-16	3.50	1 1-4	4.05	2 3-16	5.75
3-8	3.50	1 5-16	4.15	2 1-4	5.90
7-16	3.50	1 3-8	4.20	2 5-16	6.00
1-2	3.50	1 7-16	4.25	2 3-8	6.15
9-16	3.50	1 1-2	4.35	2 7-16	6.30
5-8	3.50	1 9-16	4.50	2 1-2	6.45
11-16	3.50	1 5-8	4.60	2 9-16	7.00
3-4	3.50	1 11-16	4.75	2 5-8	7.35
13-16	3.55	1 3-4	4.90	2 11-16	7.70
7-8	3.65	1 13-16	5.05	2 3-4	7.70
15-16	3.70	1 7-8	5.20	2 13-16	8.40
1	3.80	1 15-16	5.30	2 7-8	8.40
1 1-16	3.85	2	5.45	2 15-16	8.40
1 1-8	3.90	2 1-16	5.55	3	9.10

666

No. 666, Metric

Size, m/m	Price each	Size, m/m	Price each	Size, m/m	Price each
5	\$3.50	29	\$4.00	53	\$5.55
6	3.50	30	4.00	54	5.60
7	3.50	31	4.05	55	5.75
8	3.50	32	4.05	56	5.75
9	3.50	33	4.15	57	5.90
10	3.50	34	4.20	58	6.00
11	3.50	35	4.20	59	6.00
12	3.50	36	4.25	60	6.15
13	3.50	37	4.25	61	6.30
14	3.50	38	4.35	62	6.30
15	3.50	39	4.50	63	6.45
16	3.50	40	4.50	64	6.45
17	3.50	41	4.60	65	7.00
18	3.50	42	4.75	66	7.35
19	3.50	43	4.75	67	7.35
20	3.55	44	4.90	68	7.70
21	3.55	45	4.90	69	7.70
22	3.65	46	5.05	70	7.70
23	3.70	47	5.20	71	8.40
24	3.70	48	5.20	72	8.40
25	3.80	49	5.30	73	8.40
26	3.85	50	5.45	74	8.40
27	3.85	51	5.45	75	8.40
28	3.90	52	5.55	..	....

Standard Caliper Gauges

INTERNAL WITH HANDLES

No. 667, English

Style 3 up to and including 2 15-16" or 74 m/m; the rest are Style 5. See page 132.

Size, Inches	Price, each	Size, Inches	Price, each	Size, Inches	Price, each
1-4	\$1.95	1 3-8	\$2.30	2 1-2	\$3.50
5-16	1.95	1 7-16	2.30	2 9-16	3.90
3-8	1.95	1 1-2	2.40	2 5-8	4.05
7-16	1.95	1 9-16	2.45	2 11-16	4.20
1-2	1.95	1 5-8	2.50	2 3-4	4.20
9-16	1.95	1 11-16	2.65	2 13-16	4.60
5-8	1.95	1 3-4	2.80	2 7-8	4.60
11-16	1.95	1 13-16	2.80	2 15-16	4.60
3-4	2.05	1 7-8	2.95	3 to 3 1-4	4.60
13-16	2.05	1 15-16	2.95	3 5-16 to 3 1-2	4.90
7-8	2.05	2	3.10	3 9-16 to 3 3-4	5.25
15-16	2.05	2 1-16	3.10	3 13-16 to 4	5.60
1	2.10	2 1-8	3.10	4 1-16 to 5	5.95
1 1-16	2.10	2 3-16	3.20	5 1-16 to 6	6.30
1 1-8	2.15	2 1-4	3.20	6 1-16 to 7	6.65
1 3-16	2.15	2 5-16	3.20	7 1-16 to 8	7.00
1 1-4	2.25	2 3-8	3.35		
1 5-16	2.25	2 7-16	3.35		

No. 668, Metric

Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each
5	\$1.95	29	\$2.15	53	\$3.10	77	\$4.60	105	\$5.95
6	1.95	30	2.15	54	3.20	78	4.60	110	5.95
7	1.95	31	2.25	55	3.20	79	4.60	115	5.95
8	1.95	32	2.25	56	3.20	80	4.60	120	5.95
9	1.95	33	2.25	57	3.20	81	4.60	125	5.95
10	1.95	34	2.30	58	3.20	82	4.60	130	6.30
11	1.95	35	2.30	59	3.35	83	4.90	135	6.30
12	1.95	36	2.30	60	3.35	84	4.90	140	6.30
13	1.95	37	2.40	61	3.35	85	4.90	145	6.30
14	1.95	38	2.40	62	3.50	86	4.90	150	6.30
15	1.95	39	2.45	63	3.50	87	4.90	155	6.65
16	1.95	40	2.50	64	3.90	88	4.90	160	6.65
17	1.95	41	2.50	65	3.90	89	5.25	165	6.65
18	2.05	42	2.65	66	4.05	90	5.25	170	6.65
19	2.05	43	2.80	67	4.20	91	5.25	175	6.65
20	2.05	44	2.80	68	4.20	92	5.25	180	7.00
21	2.05	45	2.80	69	4.20	93	5.25	185	7.00
22	2.05	46	2.80	70	4.60	94	5.25	190	7.00
23	2.05	47	2.95	71	4.60	95	5.25	195	7.00
24	2.10	48	2.95	72	4.60	96	5.60	200	7.00
25	2.10	49	2.95	73	4.60	97	5.60	...	...
26	2.10	50	3.10	74	4.60	98	5.60	...	...
27	2.15	51	3.10	75	4.60	99	5.60	...	...
28	2.15	52	3.10	76	4.60	100	5.60	...	...

Standard Caliper Gauges

EXTERNAL

No. 669, English

Style 2 up to and including 2" or 50 m/m; the rest are Style 4. See page 132.

669

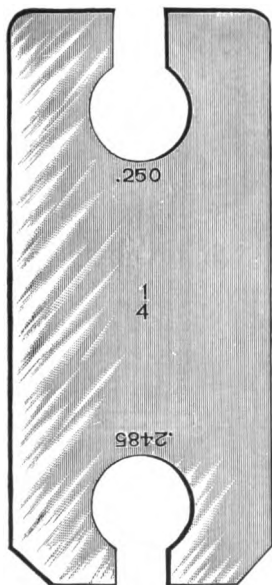
670

Size, Inches	Price, each	Size, Inches	Price, each	Size, Inches	Price, each
1-4	\$1.95	1 7-16	\$2.30	2 5-8	\$4.05
5-16	1.95	1 1-2	2.40	2 11-16	4.20
3-8	1.95	1 9-16	2.45	2 3-4	4.20
7-16	1.95	1 5-8	2.50	2 13-16	4.60
1-2	1.95	1 11-16	2.65	2 7-8	4.60
9-16	1.95	1 3-4	2.80	2 15-16	4.60
5-8	1.95	1 13-16	2.80	3 to 3 1-4	4.60
11-16	1.95	1 7-8	2.95	3 5-16 to 3 1-2	4.90
3-4	2.05	1 15-16	2.95	3 9-16 to 3 3-4	5.25
13-16	2.05	2	3.10	3 13-16 to 4	5.60
7-8	2.05	2 1-16	3.10	4 1-16 to 5	5.95
15-16	2.05	2 1-8	3.10	5 1-16 to 6	6.30
1	2.10	2 3-16	3.20	6 1-16 to 7	6.65
1 1-16	2.10	2 1-4	3.20	7 1-16 to 8	7.00
1 1-8	2.15	2 5-16	3.20	8 1-16 to 9	7.90
1 3-16	2.15	2 3-8	3.35	9 1-16 to 10	8.75
1 1-4	2.25	2 7-16	3.35	10 1-16 to 11	9.80
1 5-16	2.25	2 1-2	3.50	11 1-16 to 12	11.20
1 3-8	2.30	2 9-16	3.90		

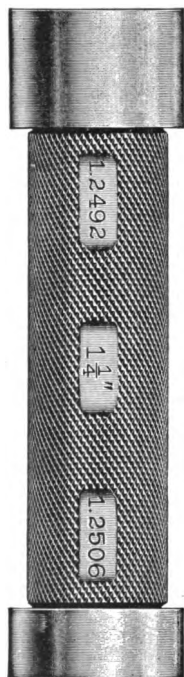
No. 670, Metric

Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each	Size, m/m	Price, each
5	\$1.95	28	\$2.15	51	\$3.10	74	\$4.60	97	\$5.60	200	\$7.00
6	1.95	29	2.15	52	3.10	75	4.60	98	5.60	205	7.90
7	1.95	30	2.15	53	3.10	76	4.60	99	5.60	210	7.90
8	1.95	31	2.25	54	3.20	77	4.60	100	5.60	215	7.90
9	1.95	32	2.25	55	3.20	78	4.60	105	5.95	220	7.90
10	1.95	33	2.25	56	3.20	79	4.60	110	5.95	225	7.90
11	1.95	34	2.30	57	3.20	80	4.60	115	5.95	230	8.75
12	1.95	35	2.30	58	3.20	81	4.60	120	5.95	235	8.75
13	1.95	36	2.30	59	3.35	82	4.60	125	5.95	240	8.75
14	1.95	37	2.40	60	3.35	83	4.90	130	6.30	245	8.75
15	1.95	38	2.40	61	3.35	84	4.90	135	6.30	250	8.75
16	1.95	39	2.45	62	3.50	85	4.90	140	6.30	255	9.80
17	1.95	40	2.50	63	3.50	86	4.90	145	6.30	260	9.80
18	2.05	41	2.50	64	3.90	87	4.90	150	6.30	265	9.80
19	2.05	42	2.65	65	3.90	88	4.90	155	6.65	270	9.80
20	2.05	43	2.80	66	4.05	89	5.25	160	6.65	275	9.80
21	2.05	44	2.80	67	4.20	90	5.25	165	6.65	280	11.20
22	2.05	45	2.80	68	4.20	91	5.25	170	6.65	285	11.20
23	2.05	46	2.80	69	4.20	92	5.25	175	6.65	290	11.20
24	2.10	47	2.95	70	4.60	93	5.25	180	7.00	295	11.20
25	2.10	48	2.95	71	4.60	94	5.25	185	7.00	300	11.20
26	2.10	49	2.95	72	4.60	95	5.25	190	7.00	...	...
27	2.15	50	3.10	73	4.60	96	5.60	195	7.00	...	...

Limit Gauges



External



Internal

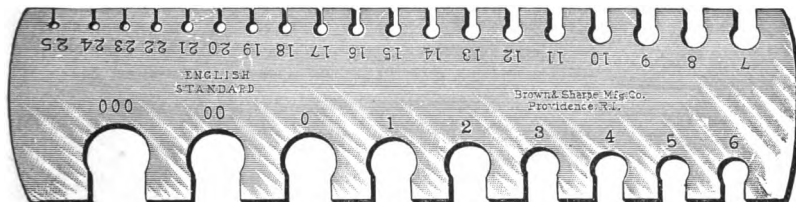
The advantage derived from the use of Limit Gauges is that the time consumed in testing and gauging is reduced to a minimum, and the accurate duplication of parts is insured. The two ends are of different shape, thus furnishing means of identifying the larger end from the smaller without reference to the size stamped on the gauge. Another and very convenient form has both sizes contained between the jaws at one end of the gauge; the large size, or maximum limit, is at the outer end of the jaws, and the small, or minimum limit, at the inner end.

In addition to their value for finishing sizes they are of great advantage in roughing work for finishing, the same amount of stock being left on each piece, making it much easier to finish them to size.

Prices are quoted on Limit or Special Gauges of all descriptions, when specifications, drawings or samples of work are sent. The dimensions required at each end of the gauge must be plainly stated in thousandths or fractions of thousandths of an inch.

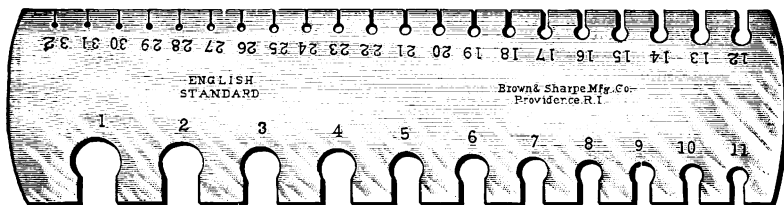
Rolling-Mill Gauges No. 684

ENGLISH OR BIRMINGHAM STANDARD



684

685



Numbers 000 to 25 Price, \$4.00

Numbers 1 to 32 Price, \$4.75

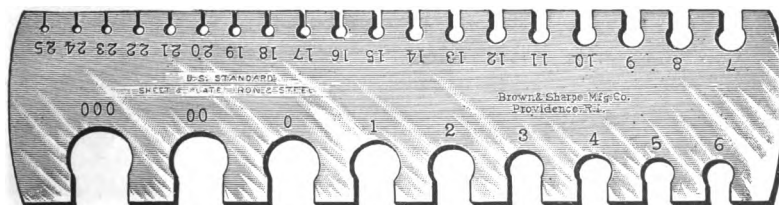
Shown about two-thirds size, these Gauges are made of steel, hardened and tempered. They are about 3-16ths of an inch thick and well adapted to the rough usage they are likely to have in rolling mills or in other places where many measurements are to be taken quickly.

Rolling-Mill Gauge No. 685

U. S. STANDARD

For Sheet and Plate Iron and Steel

Adopted by Congress, March 3, 1893



Numbers 000 to 25 Price, \$4.00

Each of the above packed six in a box.

American Standard Wire Gauges No. 688



Adopted by the
Brass Manufacturer-
ers, January, 1858

Decimal Equivalents
stamped on reverse
side.

Numbers 0 to 36
Price, \$3.00

Numbers 5 to 36
Price, \$2.50

For Table of the
Different Standards of
Wire Gauges, see page
146.

English Standard Wire Gauges No. 690

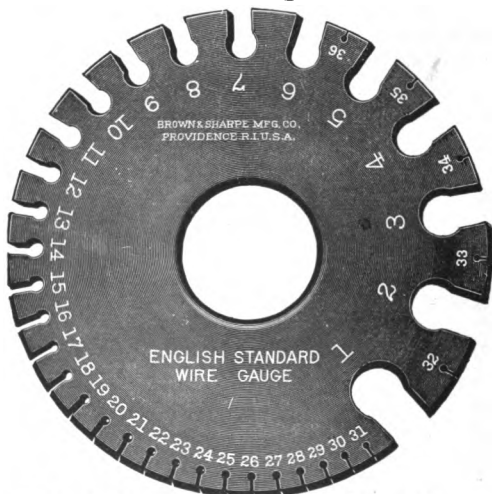
The Same as Stubs'
Iron Wire or Bir-
mingham Gauge

Decimal Equivalents
stamped on reverse
side.

Numbers 1 to 36
Price, \$3.00

Numbers 6 to 36
Price, \$2.50

For Table of the
Different Standards of
Wire Gauges, see page
146.

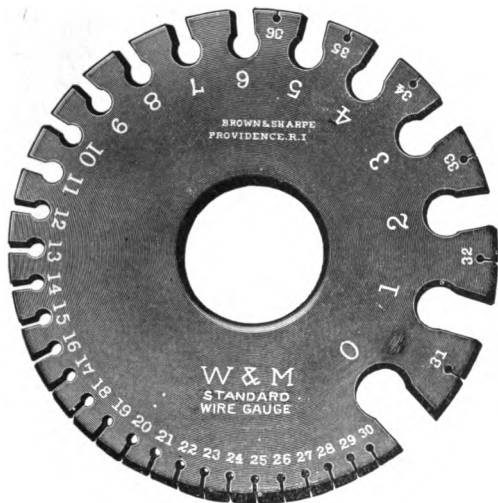


Each of the above packed as follows: Small size twelve, and
large size six in a box.

Washburn & Moen Standard Wire Gauge No. 692

692

694



Numbers 0 to 36

Price, \$3.00

For Table of the
Different Standards of
Wire Gauges, see page
146.

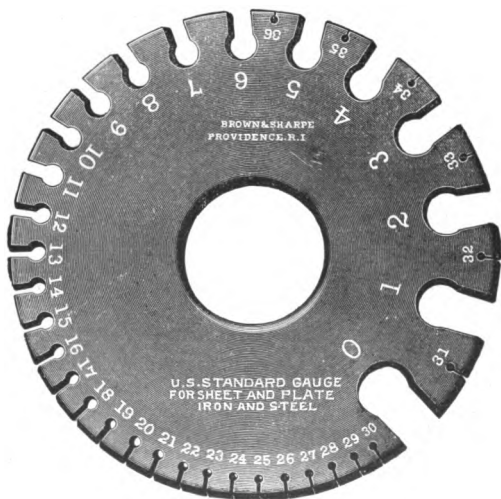
U. S. Standard Gauge No. 694

Numbers 0 to 36

Price, \$3.00

U. S. Standard
Gauge for Sheet and
Plate Iron and Steel,
adopted by Congress,
March 3, 1893.

For Table of the
Different Standards of
Wire Gauges, see page
146.



Each of the above packed six in a box.

Steel Music Wire Gauge No. 695

WASHBURN & MOEN STANDARD



Numbers
12 to 28

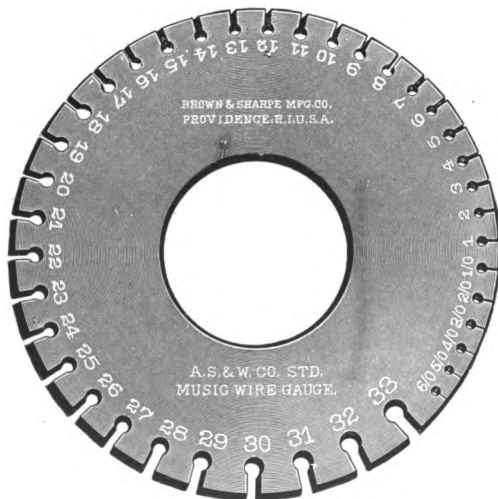
Price, \$1.80

Full Size

Decimal Equivalents stamped on reverse side
For Table of the Different Standards of Wire Gauges, see page 146.

Steel Music Wire Gauge No. 696

AMERICAN S. & W. CO.'S NEW STANDARD



Numbers 000000
to 33

Price, \$3.00

Decimal Equivalents
stamped on reverse
side.

For Table of the
Different Standards of
Wire Gauges, see page
146.

Each of the above packed six in a box.

Table of Decimal Equivalents Of Stubs' Steel Wire Gauge

Letter	Size of Letter in Decimals	No. of Wire Gauge	Size of Number in Decimals	No. of Wire Gauge	Size of Number in Decimals	No. of Wire Gauge	Size of Number in Decimals
Z	.413	1	.227	28	.139	55	.050
Y	.404	2	.219	29	.134	56	.045
X	.397	3	.212	30	.127	57	.042
W	.386	4	.207	31	.120	58	.041
V	.377	5	.204	32	.115	59	.040
U	.368	6	.201	33	.112	60	.039
T	.358	7	.199	34	.110	61	.038
S	.348	8	.197	35	.108	62	.037
R	.339	9	.194	36	.106	63	.036
Q	.332	10	.191	37	.103	64	.035
P	.323	11	.188	38	.101	65	.033
O	.316	12	.185	39	.099	66	.032
N	.302	13	.182	40	.097	67	.031
M	.295	14	.180	41	.095	68	.030
L	.290	15	.178	42	.092	69	.029
K	.281	16	.175	43	.088	70	.027
J	.277	17	.172	44	.085	71	.026
I	.272	18	.168	45	.081	72	.024
H	.266	19	.164	46	.079	73	.023
G	.261	20	.161	47	.077	74	.022
F	.257	21	.157	48	.075	75	.020
E	.250	22	.155	49	.072	76	.018
D	.246	23	.153	50	.069	77	.016
C	.242	24	.151	51	.066	78	.015
B	.238	25	.148	52	.063	79	.014
A	.234	26	.146	53	.058	80	.013
..	...	27	.143	54	.055	..	...

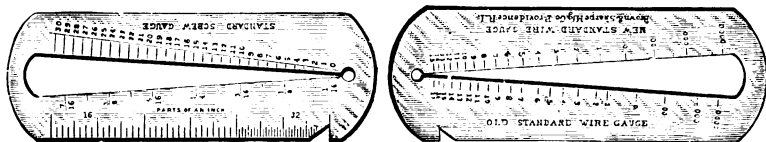
Stubs' Gauges

In using the gauges known as Stubs' Gauges, there should be constantly borne in mind the difference between the Stubs' Iron Wire Gauge and the Stubs' Steel Wire Gauge.

The Stubs' Iron Wire Gauge is the one commonly known as the English Standard Wire, or Birmingham Gauge, and designates the Stubs' *soft* wire sizes.

The Stubs' Steel Wire Gauge is the one that is used in measuring drawn steel wire or drill rods of Stubs' make and is also used by many makers of American drill rods.

Pocket Screw and Wire Gauge No. 700



Price, \$3.00

The gauge as shown is an angular gauge graduated on the front, at the right of slot, to show all sizes of the American Standard screw gauge from 0 to 30, and is designed for the measurement of wire as well as of machine and wood screws.

This gauge can also be used to show the sizes of A. S. M. E. Standard screws. Although there is a slight difference in size for the same gauge-number it is not enough to affect the reading of the gauge. For a comparison of these sizes, see next page.

A screw or wire is measured by passing it into the angular opening till it touches on both sides; the division at the point of contact indicates the number of the gauge stamped on the side of the slot.

In addition to the gauge numbers, the front side of the gauge is also graduated on the left of slot to 32nds of an inch.

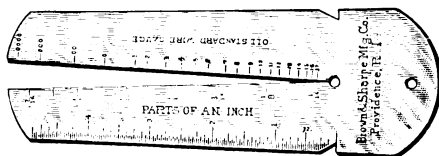
The back side of gauge is graduated as the old or English wire gauge, from 17 to 0000 on the right, and the new or American wire gauge from 15 to 0000 on the left of slot.

Large Screw and Wire Gauge No. 702

Price, \$4.20

Extra Thick, Price, \$5.50

Graduated on both sides of slot to show all sizes of the American Standard screw gauge from 0 to 30 and is designed for the measurement of wire as well as of machine and wood screws.



This gauge can also be used to show the sizes of A. S. M. E. Standard screws. Although there is a slight difference in size for the same gauge-number, it is not enough to affect the reading of the gauge.

The front of the gauge is also graduated on both edges to 8ths of an inch. An angle cut in the side allows the head of the screw to be placed against a positive stop when measuring the length.

The back of the gauge is graduated as the old or English wire gauge from 17 to 0000, on the right, and to 32nds of an inch on the left of slot. The outer left-hand edge is graduated to 32nds of an inch.

This gauge is also made about 5-32" thick and is known as "Extra Thick."

Each of the above packed six in a box.

Table of Decimal Equivalents of Screw Gauge

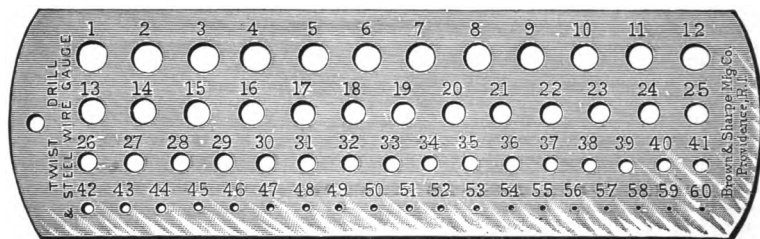
For Machine and Wood Screws

The difference between consecutive sizes is .01316" for American Screw Co. Standard; .013" for A. S. M. E. Standard.

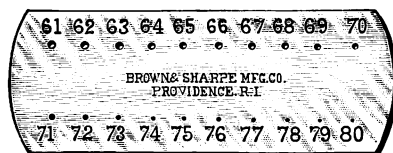
No. of Screw Gauge	Size of Number in Decimals		No. of Screw Gauge	Size of Number in Decimals		No. of Screw Gauge	Size of No. in Decimals
	American Screw Co. Standard	A. S. M. E. Basic and Maximum Outside Diameter		American Screw Co. Standard	A. S. M. E. Basic and Maximum Outside Diameter		American Screw Co. Standard
000	.03152	...	16	.26840	.268	34	.50528
00	.04468	...	17	.28156	...	35	.51844
0	.05784	.060	18	.29472	.294	36	.53160
1	.07100	.073	19	.30788	...	37	.54476
2	.08416	.086	20	.32104	.320	38	.55792
3	.09732	.099	21	.33420	...	39	.57108
4	.11048	.112	22	.34736	.346	40	.58424
5	.12364	.125	23	.36052	...	41	.59740
6	.13680	.138	24	.37368	.372	42	.61056
7	.14996	.151	25	.38684	...	43	.62372
8	.16312	.164	26	.40000	.398	44	.63688
9	.17628	.177	27	.41316	...	45	.65004
10	.18944	.190	28	.42632	.424	46	.66320
11	.20260	...	29	.43948	...	47	.67636
12	.21576	.216	30	.45264	.450	48	.68952
13	.22892	...	31	.46580	...	49	.70268
14	.24208	.242	32	.47896	...	50	.71584
15	.25524	...	33	.49212	...	..	....

Twist Drill and Steel Wire Gauges

No. 705



Nos. 1 to 60 Price, \$2.00



Nos. 61 to 80 Price, \$2.40

For use in determining the correct size of Twist Drills and Steel Drill Rods. Great care is taken to insure the accuracy of the gauge numbers. All sizes are carefully tested after hardening.

The larger Gauge is about 1-16" thick, 1 5-8" wide, 5 1-4" long and contains gauge numbers from 1 to 60, inclusive, with decimal equivalents of the various sizes stamped on reverse side. The smaller Gauge is about 1-16" thick, 3-4" wide, 2" long and contains gauge numbers from 61 to 80, inclusive. These Gauges are usually sent out finished black, but will be sent polished, if desired, at the same price.

Table of Decimal Equivalents of the Numbers of Twist Drill and Steel Wire Gauge, page 151.

Packed six in a box.

Decimal Equivalents

of the

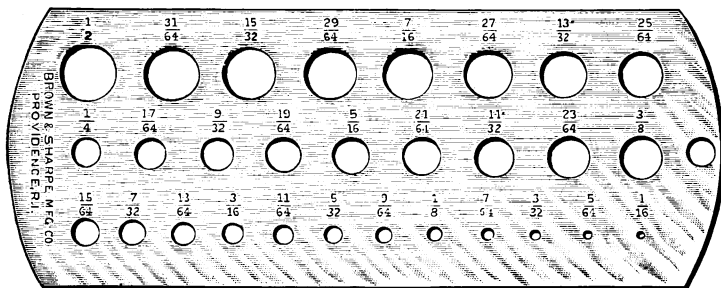
Numbers of Twist Drill and Steel Wire Gauge

No.	Size of No. in Decimals	No.	Size of No. in Decimals	No.	Size of No. in Decimals	No.	Size of No. in Decimals
1	.2280	21	.1590	41	.0960	61	.0390
2	.2210	22	.1570	42	.0935	62	.0380
3	.2130	23	.1540	43	.0890	63	.0370
4	.2090	24	.1520	44	.0860	64	.0360
5	.2055	25	.1495	45	.0820	65	.0350
6	.2040	26	.1470	46	.0810	66	.0330
7	.2010	27	.1440	47	.0785	67	.0320
8	.1990	28	.1405	48	.0760	68	.0310
9	.1960	29	.1360	49	.0730	69	.02925
10	.1935	30	.1285	50	.0700	70	.0280
11	.1910	31	.1200	51	.0670	71	.0260
12	.1890	32	.1160	52	.0635	72	.0250
13	.1850	33	.1130	53	.0595	73	.0240
14	.1820	34	.1110	54	.0550	74	.0225
15	.1800	35	.1100	55	.0520	75	.0210
16	.1770	36	.1065	56	.0465	76	.0200
17	.1730	37	.1040	57	.0430	77	.0180
18	.1695	38	.1015	58	.0420	78	.0160
19	.1660	39	.0995	59	.0410	79	.0145
20	.1610	40	.0980	60	.0400	80	.0135

Jobbers' Drill Gauge No. 710

For Gauging Twist Drills

Hardened and Tempered



Price, \$2.75

The sizes are carefully tested for accuracy after tempering.

This Gauge is usually sent out finished black, but will be sent polished, if desired, at the same price.

Equivalents of Sizes in Decimal Parts of an Inch

Size, Inches	Decimal	Size, Inches	Decimal
1-16	.0625	19-64	.29687
5-64	.07812	5-16	.3125
3-32	.09375	21-64	.32812
7-64	.10937	11-32	.34375
1-8	.125	23-64	.35937
9-64	.14062	3-8	.375
5-32	.15625	25-64	.39062
11-64	.17187	13-32	.40625
3-16	.1875	27-64	.42187
13-64	.20312	7-16	.4375
7-32	.21875	29-64	.45312
15-64	.23437	15-32	.46875
1-4	.25	31-64	.48437
17-64	.26562	1-2	.50
9-32	.28125	....	....

Packed six in a box.

Sizes of Tap Drills for U. S. Standard Threads

By the formulas given below, the results, strictly speaking, are the diameters of the bottoms of the threads. The tap drill is, in common practice, one or two numbers larger, for the smaller, or numbered sizes, and about .005" larger for the larger sizes. The amount allowed for clearance varies in different shops and on different classes of work.

Bottom of Thread Diameter for U. S. Standard Thread = outside diameter of Screw - $\frac{1.299}{\text{Threads per inch}}$

Bottom of Thread Diameter for 3-4" Screw, U. S. Standard Thread, 10 threads to the inch = $.750 - \frac{1.299}{10} = .750 - .1299 = .6201$.

Diameter of Screw, Inches	Threads per Inch	Diameter at Bottom of Thread, Inches	Diameter of Screw, Inches	Threads per Inch	Diameter at Bottom of Thread, Inches
1-4	20	.185	2	4 1-2	1.712
5-16	18	.240	2 1-4	4 1-2	1.962
3-8	16	.294	2 1-2	4	2.176
7-16	14	.344	2 3-4	4	2.426
1-2	13	.400	3	3 1-2	2.629
9-16	12	.454	3 1-4	3 1-2	2.879
5-8	11	.507	3 1-2	3 3-4	3.100
3-4	10	.620	3 3-4	3	3.317
7-8	9	.731	4	3	3.567
1	8	.837	4 1-4	2 7-8	3.798
1 1-8	7	.940	4 1-2	2 3-4	4.028
1 1-4	7	1.065	4 3-4	2 5-8	4.256
1 3-8	6	1.160	5	2 1-2	4.480
1 1-2	6	1.284	5 1-4	2 1-2	4.730
1 5-8	5 1-2	1.389	5 1-2	2 3-8	4.953
1 3-4	5	1.491	5 3-4	2 3-8	5.203
1 7-8	5	1.616	6	2 1-4	5.423

Sizes of Tap Drills for V Threads

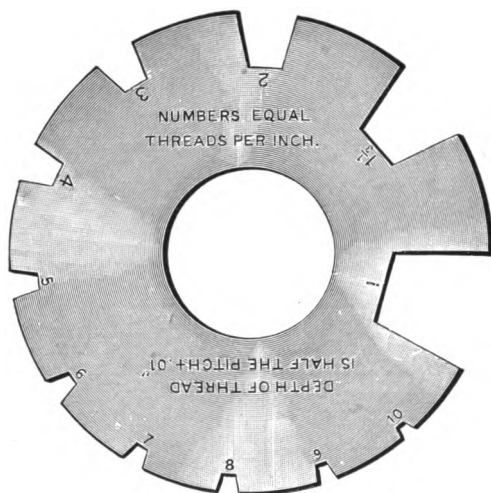
Bottom of Thread Diameter for V Thread = outside diameter of Screw - $\frac{1.732}{\text{Threads per inch}}$

Bottom of Thread Diameter for 3-4" V Thread, 10 threads per inch = $.750 - \frac{1.732}{10} = .750 - .1732 = .5768$, diameter at bottom of thread.

The Tap Drill should be from .010 larger than above figures on small sizes to .030 larger on large sizes.

29° Screw Thread Gauge No. 715

ACME STANDARD



Full Size

Price, \$3.30

The purpose of this gauge is to furnish a correct standard to which tools can be ground to cut threads of a uniform angle to take the place of square threads, and to standardize the threads of various angles and depths now in use. The Acme thread has the same depth as the square threads, but is stronger.

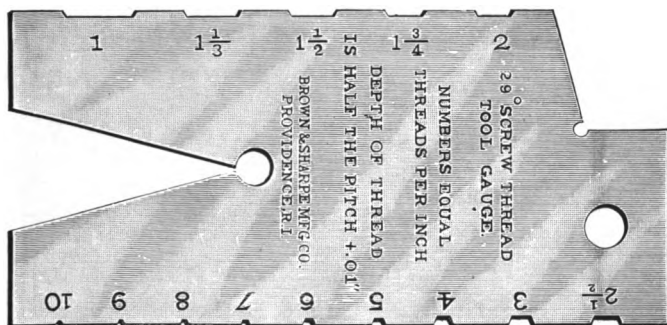
The sides are at an inclination of $14\ 1/2^\circ$, or 29° included angle, which angle is the same as is now generally adopted in cutting worms.

A tool setting gauge is furnished and included in the price of each gauge.

Packed six in a box.

Improved 29° Screw Thread Tool Gauge No. 716

ACME STANDARD



Price, \$3.00

This Gauge furnishes a correct standard to which tools can be ground for cutting threads of a uniform angle to take the place of square threads.

The Acme thread has the same depth as the square threads, but as the sides are at an inclination of $14\ 1-2^\circ$ (29° included angle) this form of thread is stronger.

Made of the best steel, tempered, adjusted and all angles carefully tested after hardening.

Packed twelve in a box.

716

29° Screw Thread

ACME STANDARD

The various parts of the 29° Screw Thread, Acme Standard, are obtained as follows:

Width of Point of Tool for

$$\text{Screw or Tap Thread} = \frac{.3707}{\text{Threads per inch}} - .0052$$

$$\text{Width of Screw or Nut Thread} = \frac{.3707}{\text{Threads per inch}}$$

Diameter of Tap = Diameter of Screw + .020

Diameter of Tap or Screw at Root =

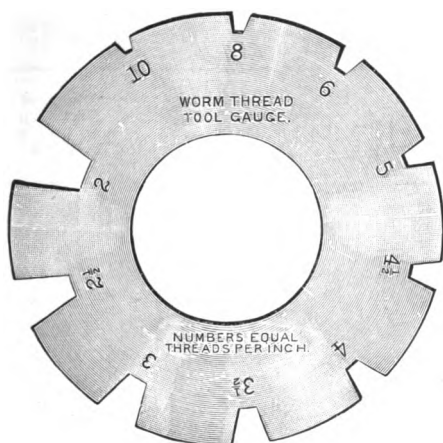
$$\text{Diameter of Screw} - \left(\frac{1}{\text{Threads per inch}} + .020 \right)$$

$$\text{Depth of Thread} = \frac{1}{2 \times \text{Threads per inch}} + .010$$

Table of Thread Parts

Threads per Inch	Depth of Thread, Inches	Thickness at Top of Thread, Inches	Width Space at Bottom of Thread, Inches	Space at Top of Thread, Inches	Thickness at Root of Thread, Inches
1	.5100	.3707	.3655	.6293	.6345
1 1-3	.3850	.2780	.2728	.4720	.4772
2	.2600	.1853	.1801	.3147	.3199
3	.1767	.1235	.1183	.2098	.2150
4	.1350	.0927	.0875	.1573	.1625
5	.1100	.0741	.0689	.1259	.1311
6	.0933	.0618	.0566	.1049	.1101
7	.0814	.0529	.0478	.0899	.0951
8	.0725	.0463	.0411	.0787	.0839
9	.0655	.0413	.0361	.0699	.0751
10	.0600	.0371	.0319	.0629	.0681

Worm Thread Tool Gauge No. 720



Full Size

Price, \$3.00

Price, with Tool Setting
Gauge, \$3.30

Furnishes the correct form for tools used in turning the threads of worms when the worm wheels are cut with involute cutters. The figures on the gauge correspond to the number of threads per inch of the worm.

Standard Screw Thread Tool Gauge No. 724

Price, \$3.00

To be used as a standard for grinding tools to cut threads according to the United States Standard.

The angles are 60° , and the flat surfaces at top and bottom of threads are equal to one-eighth of the pitch.



Full Size

Each of the above packed six in a box.

U. S. Standard Screw Threads

Diameter of Screw at Top of Thread, Inches	Threads per Inch	Diameter at Root of Thread, Inches	Width of Flat, Top and Bottom, Inches
1-4	20	.1850	.0063
5-16	18	.2403	.0069
3-8	16	.2936	.0078
7-16	14	.3447	.0089
1-2	13	.4001	.0096
9-16	12	.4542	.0104
5-8	11	.5069	.0114
3-4	10	.6201	.0125
7-8	9	.7307	.0139
1	8	.8376	.0156
1 1-8	7	.9394	.0179
1 1-4	7	1.0644	.0179
1 3-8	6	1.1585	.0208
1 1-2	6	1.2835	.0208
1 5-8	5 1-2	1.3888	.0227
1 3-4	5	1.4902	.0250
1 7-8	5	1.6152	.0250
2	4 1-2	1.7113	.0278
2 1-4	4 1-2	1.9613	.0278
2 1-2	4	2.1752	.0313
2 3-4	4	2.4252	.0313
3	3 1-2	2.6288	.0357
3 1-4	3 1-2	2.8788	.0357
3 1-2	3 1-4	3.1003	.0385
3 3-4	3	3.3170	.0417
4	3	3.5670	.0417
4 1-4	2 7-8	3.7982	.0435
4 1-2	2 3-4	4.0276	.0455
4 3-4	2 5-8	4.2551	.0476
5	2 1-2	4.4804	.0500
5 1-4	2 1-2	4.7304	.0500
5 1-2	2 3-8	4.9530	.0526
5 3-4	2 3-8	5.2030	.0526
6	2 1-4	5.4226	.0556

Depth of Gear Tooth Gauges No. 725



725

Regular pitches from 3 to 48, inclusive

Price, 60 Cents Each

728

Other sizes made to order — Prices on application

Depth of Gear Tooth Gauges for all regular pitches, from 3 to 48 pitch, inclusive, are carried in stock. One gauge answers for each pitch and indicates the extreme depth to be cut.

Packed one in a package.

Wheel Defect, Worn Coupler Limit and Worn Journal Collar Gauge No. 728



Price, \$3.00

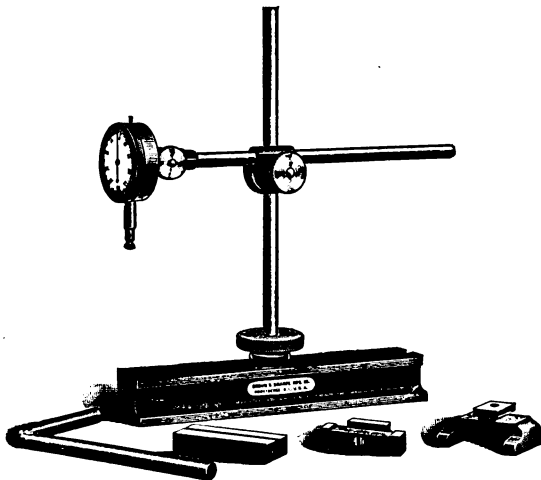
Designed for ascertaining the extent of defects and wear in car wheels, journal collars and couplers, according to the standard adopted by the Master Car Builders' Association.

It is shown about half size and is made of the first quality tool steel, hardened. The measuring surfaces are accurately ground and finished to size. After hardening, they are carefully tested for accuracy.

Packed six in a box.

Dial Test Indicator No. 730

ENGLISH OR METRIC MEASURE



Diameter of Dial, 1 3-4"

Spindle has
1-4" movement
(Metric 7 m/m)

Length of Base, 8 1-2"

Width, 2 1-4"

Price, \$30.00

This Indicator is especially serviceable to erectors or inspectors of machines, for determining the inaccuracy in a surface or the movements of a spindle or arbor, etc.

The parts are adjustable to any angle. The arm can be removed from the post and used independently, as in the tool post of a lathe. The points are removable to permit the use of different forms. The movement of the measuring surface that bears upon the work is magnified a number of times and indicated by the pointer.

English Measure. The dial reads to thousandths of an inch, has a white enamel face and is adjustable to allow the setting of the zero to any required position.

Metric Measure. Also made with Metric Dial which reads to hundredths of a millimetre.

Dial Test Indicator No. 732

ENGLISH OR METRIC MEASURE

Price, \$48.00

Differs from Dial Test Indicator No. 730 in the range and size. It is designed for a heavier class of work. Diameter of dial, 2 1-4". Spindle has 1-2" (Metric 13 m/m) movement. Length of base, 10"; width, 3".

The lathe attachment (angular arm and split block) is not furnished with this indicator.

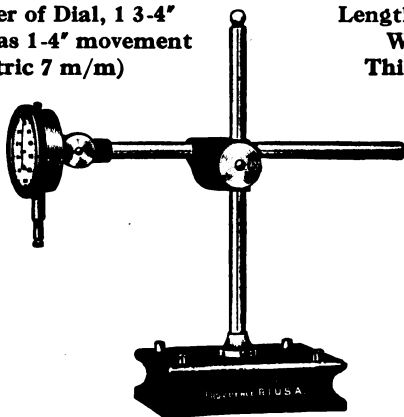
Each of the above packed one in a box.

Dial Test Indicator No. 733

ENGLISH OR METRIC MEASURE

Diameter of Dial, 1 3-4"
Spindle has 1-4" movement
(Metric 7 m/m)

Length of Base, 4 1-4"
Width, 3 1-4"
Thickness, 1 1-8"



Price, \$24.00

Differs from Dial Test Indicator No. 730, shown on the preceding page, in the design of the base which is large and sufficiently heavy to give a firm support. It has four gauge pins at the corners that can be pushed down and used against a plate, straight edge or the side of a T slot. The form of the base permits a good hand grip when moving the Indicator.

English Measure. The dial reads to thousandths of an inch, has a white-enamel face, and is adjustable to allow the setting of the zero to any required position. The spindle has 1-4" movement.

Metric Measure. Also made with a Metric Dial that reads to hundredths of a millimetre. The spindle has a movement of 7 millimetres.

Universal Attachment No. 734

For Use on Dial Test Indicators Nos. 730, 732 and 733

Designed for testing internal and other surfaces that cannot be reached conveniently with the regular straight spindle of the indicator.

It consists of a small steel cylinder that clamps over the end of the indicator spindle. Inside the cylinder a small rod rests against the indicator point. This rod is actuated vertically by the attachment indicating point that extends at right angles to the regular indicator spindle and is so placed that it produces a direct thrust against the end of the spindle without friction on the side of the cylinder.



Price, \$3.00

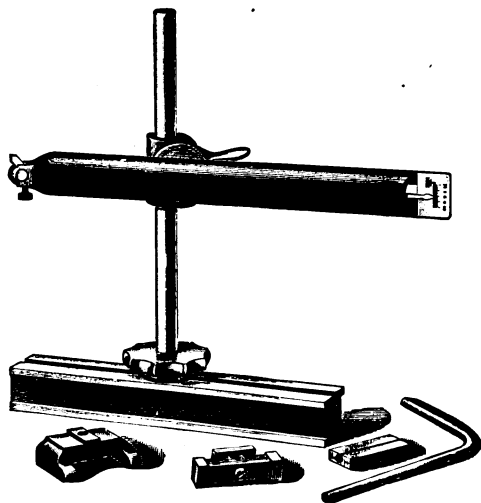
Each of the above packed one in a box.

733

734

Test Indicator No. 735

ENGLISH OR METRIC MEASURE



Price, \$25.00

Length of Base, 8"

Height of Post, 9"

To erectors or inspectors of machines, this Indicator is especially useful. The parts are adjustable to any angle. The movement of the point is magnified a number of times by the length of the index finger, and its movement may be read upon the graduations shown. The indexing finger may be brought to zero by the knurl-headed screw shown, whatever may be the position of the arm.

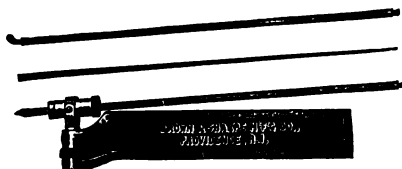
English Measure. The scale reads to thousandths of an inch.

Metric Measure. Also made to read to fiftieths of a millimetre.

Packed one in a box.

Lathe Test Indicator No. 736

Price, \$3.75



Made of steel and of such a size as to be held conveniently in the tool post of a lathe. The bar, 15-16" wide and 3-8" thick, is drop forged and formed at the end to receive a Universal Joint for supporting the finger holder.

A **Clamp Nut** is provided for clamping the joint when it is desired to have only a vertical movement to the finger, as in testing pieces held between centres, the inside or outside of pulleys, etc. The bushing which holds the finger is split, thus allowing the finger to be adjusted to lengths required and clamped in position.

The finger holder is furnished with two fingers, either one of which can be quickly attached; one finger is ground to an angle of 60° and the other is bent for inside and outside testing. A spiral spring is provided for holding the finger against the work with an even pressure.

B & S Indicator No. 738



ENGLISH OR METRIC MEASURE
Price, \$10.00 Morocco Case, \$0.80

For use in setting centrally any point or hole in a piece of work to be operated upon in a lathe or upon a face plate, also for testing lathe centres, shafting, and other work held between centres, the inside and outside diameters of cylinders, pulleys, etc., and work of a similar nature.

The shank is made of hardened steel and is designed to be held in the tool post of a lathe. By means of the swivel at one end of the shank, the Indicator may be adjusted either upwards or downwards and readings obtained.

The Indicator point is of steel, hardened, and is made spherical, allowing of pressure being brought upon it by the work from any angle and readings taken.

The readings are obtained by means of the pointer and scale on the top of the case.

English Measure. The scale is graduated to read by thousandths of an inch to approximately .007" either side of zero. In this way, the amount that the piece may run out of true, both under and over size, is easily ascertained.

Metric Measure. Also made to read by hundredths of a millimetre to approximately 1 m/m either side of zero.

Each of the above packed one in a box.

736

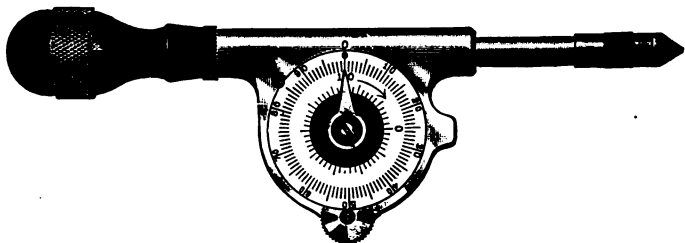
738

B & S Speed Indicator No. 748

Price, \$6.75

In Morocco Case, \$7.25

Patented March 8, 1910



The speed of shafts and spindles running in either direction may be determined by the use of this Indicator. It registers on either side, the front side being used to determine the speed of shafts and spindles running in one direction and the reverse side the speed of those running in the opposite direction. Thus the confusion and errors that arise where all readings are taken from one dial are avoided.

The dials register units and tens by means of a revolving pointer, and, in addition, the front dial registers hundreds up to 5000 by means of a rotating disk in the centre. This disk will register when either side is used.

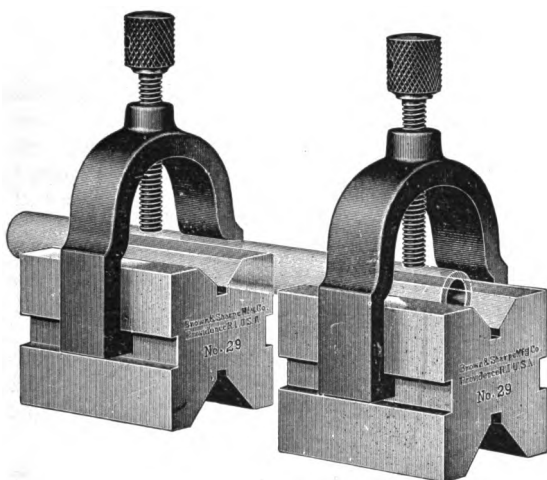
Quick use of the tool is greatly facilitated by means of a small knurled wheel on the side of the case which, when turned, reverts the rotating disk on the front dial to the starting point. This is distinctly a B & S feature. The pointers are readjusted by simply turning the indicator spindle.

The Indicator is small, light and convenient to handle. All of the working mechanism is encased, and the case is heavily nicked with a dull finish. The point is of steel, hardened and can be readily replaced when worn.

Packed one in a box.

V Blocks and Clamps No. 750

750



Price per pair, \$6.75

Designed particularly for accurately laying out work in connection with a surface plate and knee.

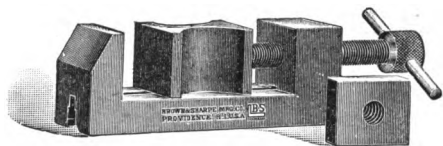
The blocks, which are made of tool steel, hardened, have the sides ground parallel and the V grooves carefully ground central and parallel to the bottom and sides. They are made and sold only in numbered pairs, so that the V grooves in blocks of the same numbers are always in alignment.

Each block is approximately 1 1-4" x 1 1-4" x 1 5-8" in size and will take work to 1" in diameter.

Not sold singly.

Packed one pair in a box.

B & S Toolmakers' Vise No. 752

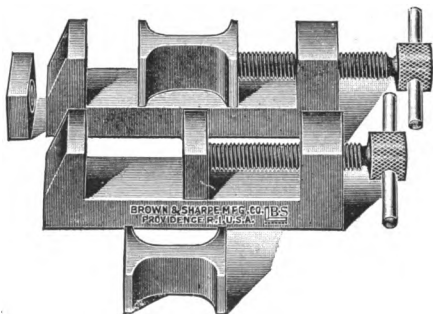


Price, \$3.50

This Vise is a reliable and handy tool for use in drilling, fitting and laying out work on surface plates. The screw will hold the jaws rigidly in place. It is case-hardened and the base ground. It is also light and convenient to handle, being frequently held in the hand during operations. The V groove in the under side of the base takes work from 9-32" to 11-16" diameter and thus adds to the handiness of the vise as it can be used as a V block.

The large jaw is provided with a tongue which slides in a groove in the base and which is held in place by a strap. This feature enables the vise to hold the work firmly and prevents the jaw from lifting. The strap can be removed and by using the jaw upside down, taper pieces can be held in the tool. The greatest capacity of the vise is 2". Each vise is furnished, as shown in the cut, with two steel jaws that slip on and off the screw.

Toolmakers' Vise Clamp No. 753



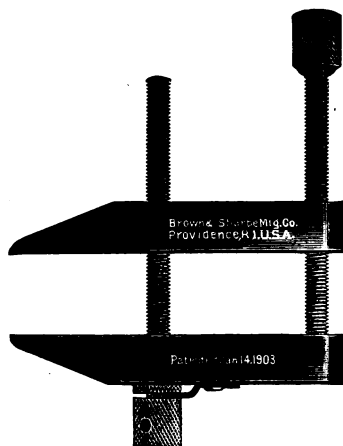
Price, \$1.50 each

Similar in appearance to Toolmakers' Vise No. 752, but it is not provided with the V groove in the base. The tongue on the larger jaw and its corresponding slot are also omitted. These vises are generally used in pairs for holding work to be drilled, etc.

Each of the above packed one in a box.

Improved Toolmakers' Clamps No. 754

754



These Clamps are designed and proportioned throughout to insure the greatest strength and rigidity. The jaws are rounded on the ends to allow clamping under a shoulder or recess. The spring attachment holds the "loose" jaw tightly and prevents its dropping or sliding while opening or closing the clamp.

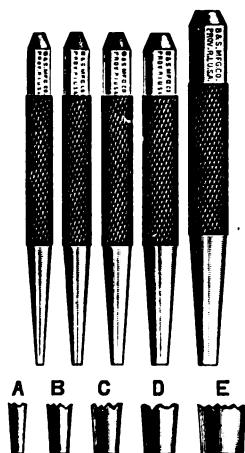
They are very convenient where a large number of pieces of the same size are to be clamped for drilling, as the spring attachment holds the jaws at the required distance for removing and inserting each piece.

No.	Opening of Jaws, Inches	Length of Jaws, Inches	Price each
754	5-8	1 1-2	\$0.70
	1	2 1-8	.85
	1 1-2	2 3-4	1.00
	2	3 3-8	1.20
	2 1-2	4	1.30
	3 1-2	5	2.10

Packed one in a box.

Nail Sets No. 762

Of tool steel, carefully hardened. They are of convenient sizes, about 4" in length and are knurled to provide a good finger grip. The points are concave and the edges rounded.



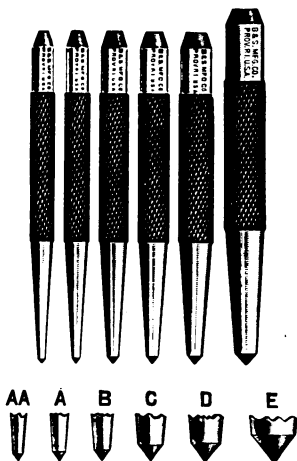
Full Size

Number	Diameter at Point, Inches	Price
762 {	A 1-16	\$0.25
	B 3-32	.25
	C 1-8	.25
	D 5-32	.25
	E 7-32	.30

Price per dozen, \$2.75

Machinists' Centre Punches No. 765

Made with the intention that they shall be a little better than the ordinary requirements of such tools demand. They are of convenient sizes and knurled on the body to afford a good finger grip. Both ends are tempered, and the points carefully ground to an angle. They are about 4" in length.



Full Size

Number	Diameter at Top of Tapered Point, Inches	Price
765 {	AA 1-16	\$0.25
	A 5-64	.25
	B 3-32	.25
	C 9-64	.25
	D 5-32	.25
	E 15-64	.25

Price per dozen, \$2.75

Each of the above packed six in a box.

Automatic Centre Punches No. 770

Style 1, 4 1-8" long, 3-8" diameter, Price, \$1.50

Style 2, 5 1-4" long, 5-8" diameter, Price, \$1.80

Style 3, 6" long, 3-4" diameter, Price, \$3.00



The Automatic Centre Punch is more convenient for laying out the work to be drilled than the ordinary centre punch and hammer.

The tool is of steel, the striking mechanism being enclosed in the knurled handle, which is of such a size and form as to be held conveniently in the hand. A downward pressure releases the striking block and makes the impression. The punch marks are of uniform depth.

The points on Styles 2 and 3 can be taken out for grinding and are easily replaced if broken.

Style 1 is adapted for carrying in the pocket, and is made to meet the demand for a small, light tool of its class suitable for the more delicate work required in tool making.

Style 3 differs from the Style 2 in being slightly heavier in construction and capable of striking a much heavier blow.

Extra Points for either Style 2 or 3 Punch, 20 cents.

Packed one in a box.

Automatic Centre Punch No. 771

Price, \$2.50

Adjustable

5 1-4" long, 5-8" diameter



Similar in construction to Automatic Centre Punch No. 770, excepting that the length of stroke is adjustable. This feature is one that is readily appreciated by mechanics, as it adapts the tool to all varieties of tool and general shop work.

For example: If a piece of tool work is to be laid out, fine punch marks are required for the outline, but for general shop work, as centring for drills, etc., much heavier marks are necessary, and the convenience of having a tool that can be readily adjusted to meet both conditions is apparent.

The adjustment of the stroke is made by the knurled thumb screw on the top of the handle. To adjust for fine work requiring a light mark, turn the screw to the right; for coarse work, turn screw to the left.

The points can be taken out for grinding and are easily replaced if broken.

Extra Points, Price, 20 cents each

Packed one in a box.

Spacing Attachment No. 775

Price, \$3.00

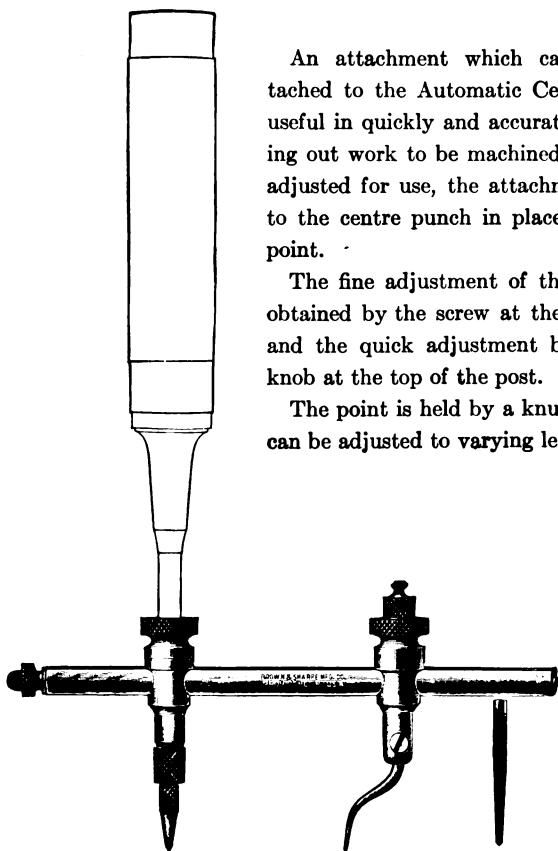
Capacity, Beam 4" Long, Swings 8"

To be used with No. 770, Style 2, and No. 771
Automatic Centre Punches

An attachment which can be quickly attached to the Automatic Centre Punch. It is useful in quickly and accurately spacing or laying out work to be machined or drilled. When adjusted for use, the attachment is screwed on to the centre punch in place of the removable point.

The fine adjustment of the locating point is obtained by the screw at the end of the beam, and the quick adjustment by pulling out the knob at the top of the post.

The point is held by a knurled check nut and can be adjusted to varying lengths.



Extra Points
for Attachment

Price,
\$0.20 each

Packed one in a box.

775

B & S Scribes No. 778



Style 2

Style 1, Single Point, Pocket

Price, 50 cents

Style 2, Single Point, 5' long

Price, 35 cents

Style 3, Double Point, 8' long

Price, 40 cents

Style 1 is adapted for carrying in the pocket. The point is held in the handle by a four-jawed chuck, by which it can be set concentrically and held firmly at any position. The point may be reversed and the scribe closed to about 3 1-2' in length for carrying in the pocket.

The points of the B & S scribes, styles 2 and 3, are threaded to screw into the holder and knurled for a finger grip. The knurled holder has long bearings to support the points firmly when in place and is of suitable size to be held conveniently.

The points are of tool steel, finely tempered.

Packed six in a box.



Style 3



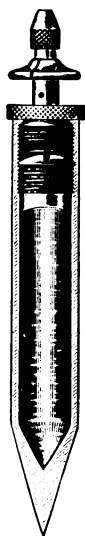
Style 1

Mercury Plumb Bobs No. 790

An important feature is the device for fastening the string without a knot. After unwinding the required length, the cord is inserted in a slot in a taper stud, and the knurled cap, which has a taper hole, is forced over it, thus making the bob hang true.

These Plumb Bobs are made from a solid steel rod, bored out and filled with mercury, or quick-silver, which makes them unusually heavy in proportion to their size. The centre of gravity is low. The cut at the left shows the manner in which these plumb bobs are constructed. The comparatively small diameters allow them to be used close to corners and walls. They are not easily affected by draughts of air and may be conveniently carried or packed in small spaces.

The points are hardened, and the bodies and points are ground. The plumb bobs are nickel plated, and each is furnished with a braided silk line. The 3 1-2 oz. can be carried easily in the vest pocket.



Prices

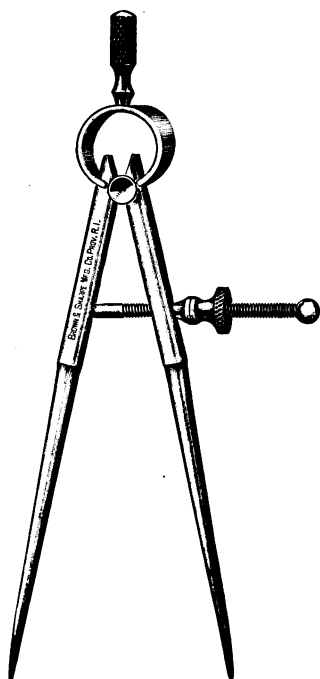
3 1-2 oz.	4" long	1-2" diam.	\$1.80
6 "	4 1-2 "	5-8 "	2.40
12 "	5 3-8 "	7-8 "	3.00
16 "	6 "	1 "	3.60

Packed one in a box.

B & S Toolmakers' Calipers and Dividers

Present features not previously embodied in tools of this class. The fulcrum stud is hardened. The spring is unusually stiff and of a construction that insures rigidity, prevents side deflection of the legs and gives uniform pressure. The legs are of steel, round and highly polished; the measuring points come together evenly.

Especial attention is called to the 2" sizes, as they are convenient for small, light work and for the pocket.

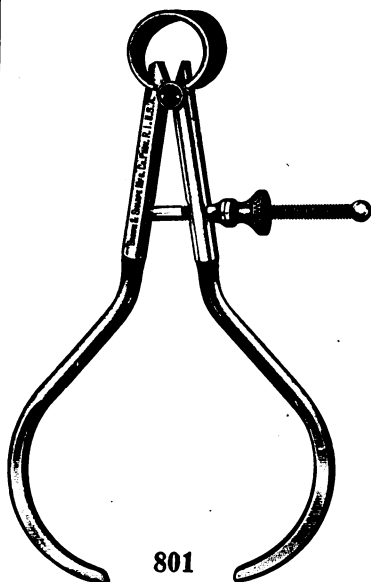


B & S Toolmakers' Dividers No. 800

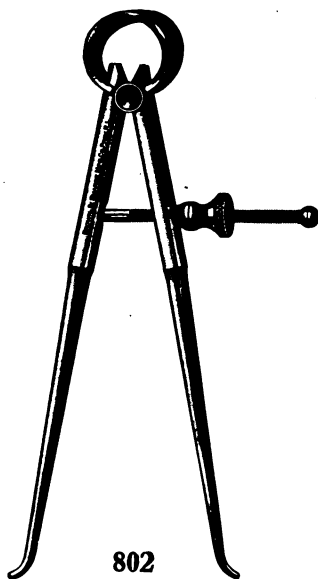
No.	Size, Inches	Price
800	2	\$1.20
	3	1.50
	4	1.80
	5	1.80
	6	2.10

Packed two in a box.

B & S Toolmakers' Outside and Inside Calipers



801
Outside



802
Inside

801

802

No.	Size, Inches	Price	No.	Size, Inches	Price
801	2	\$1.20	802	2	\$1.20
	3	1.50		3	1.50
	4	1.80		4	1.80
	5	1.80		5	1.80
	6	2.10		6	2.10

Duplicate Parts for Toolmakers' Calipers and Dividers

Leg	\$0.40
Screw and Ball . . . . .	.20
Nut . . . . .	.15
Spring . . . . .	.30
Spring with Thumb Attachment for Dividers . . . . .	.50
Thumb Attachment . . . . .	.20
Nut Washer . . . . .	.05
Fulcrum Stud . . . . .	.15

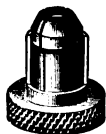
Each of the above packed two in a box.

Brown & Sharpe Spring Calipers and Dividers

Combine lightness and durability. The legs are steel drop forgings finished in the best manner possible.

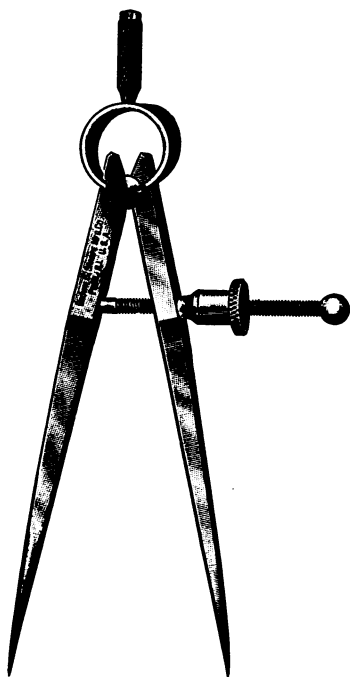
The spring is unusually stiff and of improved form, with convex ends that fit into concave grooves, milled in the ends of the legs, insuring great rigidity.

The spring nut is constructed on the principle of the spring chuck and has hardened jaws. It is positive in action when closing, the thread engaging the screw on the slightest pressure. When the pressure is withdrawn the nut is released at once and slides freely on the screw.



It is dust proof and combines all the advantages of the solid nut with that of quick adjustment. There are no loose pieces. The screw is of steel hardened to prevent wear.

A thumb attachment for convenience in handling is provided on Spring Dividers.

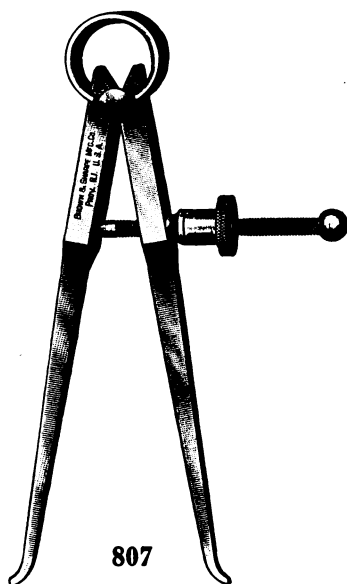
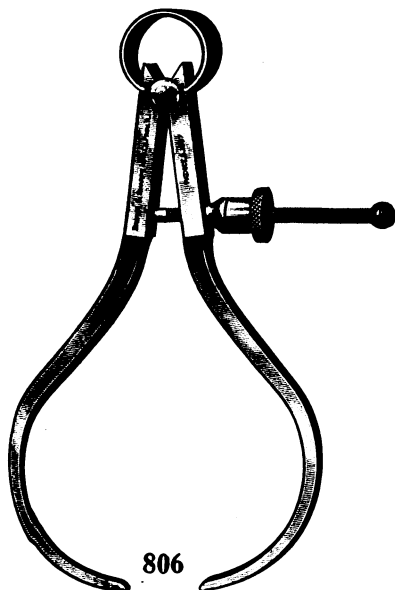


B & S Spring Dividers No. 805

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
805	2 1-2	\$1.40	\$1.20
	3	1.40	1.20
	4	1.70	1.50
	5	1.70	1.50
	6	2.10	1.95

Packed two in a box.

Brown & Sharpe Outside and Inside Spring Calipers



Outside

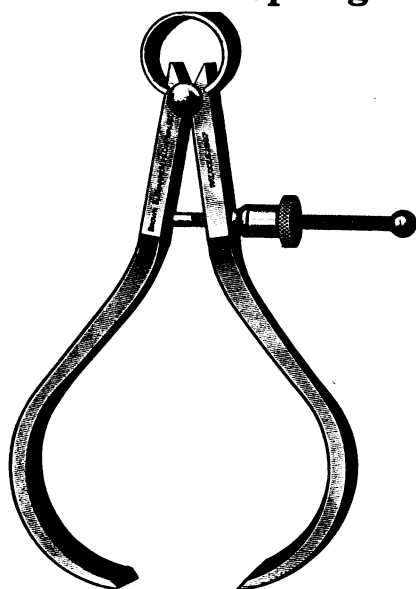
No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
806	2 1-2	\$1.40	\$1.20
	3	1.40	1.20
	4	1.50	1.35
	5	1.50	1.35
	6	1.80	1.65

Inside

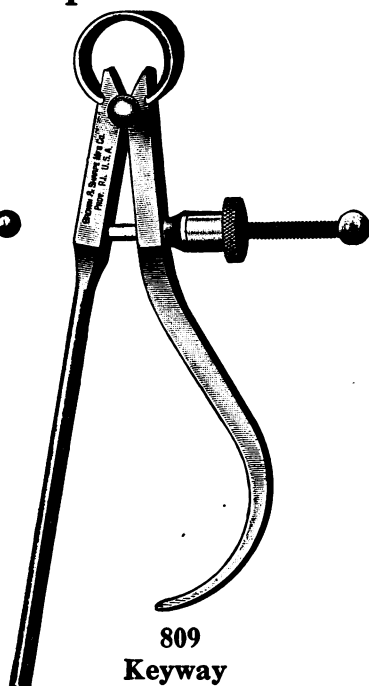
No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
807	3	\$1.40	\$1.20
	4	1.50	1.35
	5	1.50	1.35
	6	1.80	1.65

Each of the above packed two in a box.

Brown & Sharpe Thread and Keyway Spring Calipers



808
Thread



809
Keyway

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut	No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
808	3	\$1.40	\$1.20	809	3	\$1.40	\$1.20
	4	1.50	1.35		4	1.50	1.30
	5	1.50	1.35				

Duplicate Parts for Brown & Sharpe Spring Calipers and Dividers

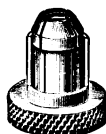
Leg	\$0.40
Screw and Ball . . . . .	.20
Solid Nut . . . . .	.15
Spring . . . . .	.30
Spring with Thumb Attachment for Dividers . . . . .	.50
Spring Nut . . . . .	.30
Nut Washer . . . . .	.15
Thumb Attachment . . . . .	.20

Each of the above packed two in a box.

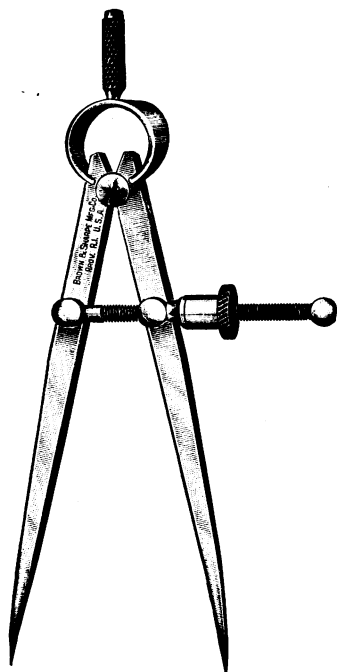
Rex Spring Calipers and Dividers

THESE are somewhat lighter than the Brown & Sharpe, but the same care is taken in their construction as in the more expensive line: the same spring, fitted to the legs in a somewhat different manner, is used and the same Spring Nut.

The Rex Calipers are neat and attractive in appearance, and durable.



The adjusting screw is hardened to prevent wear. A thumb attachment for convenience in handling is provided on Spring Dividers.

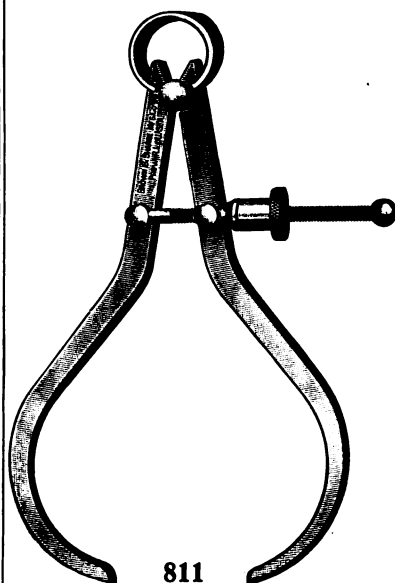


Rex Spring Dividers No. 810

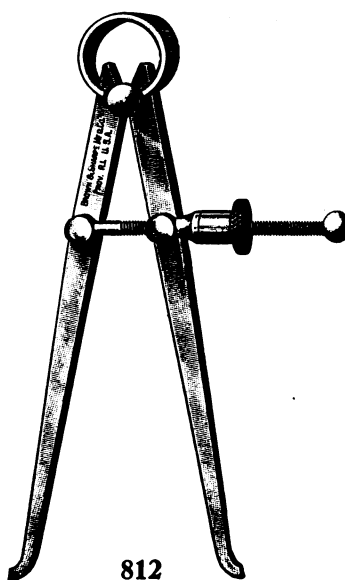
No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
810	2 1-2	\$1.00	\$0.80
	3	1.05	.85
	4	1.10	.90
	5	1.15	1.00
	6	1.20	1.05
	8	1.50	1.35

Packed two in a box.

Rex Outside and Inside Spring Calipers



811
Outside



812
Inside

No.	Size, Inches	Price with Spring Nut	Price with Solid Nut	No.	Size, Inches	Price with Spring Nut	Price with Solid Nut
811	2 1-2	\$1.00	\$0.80	812	2 1-2	\$1.00	\$0.80
	3	1.05	.85		3	1.05	.85
	4	1.10	.90		4	1.10	.90
	5	1.15	1.00		5	1.15	1.00
	6	1.20	1.05		6	1.20	1.05
	8	1.40	1.20		8	1.40	1.20

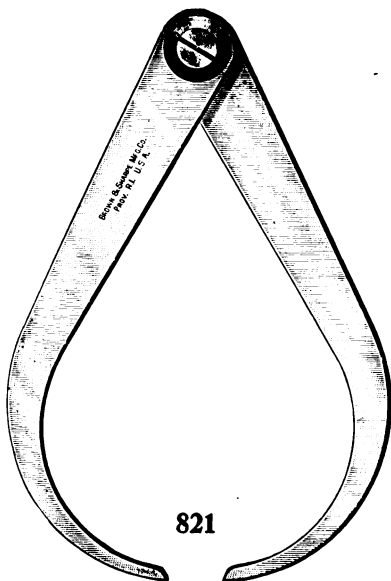
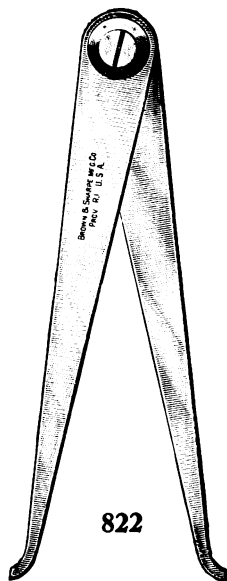
Duplicate Parts for Rex Calipers and Dividers

Leg	\$0.30
Screw and Ball . . . . .	.20
Solid Nut . . . . .	.15
Spring . . . . .	.30
Spring with Thumb Attachment for Dividers . . . . .	.50
Spring Nut . . . . .	.30
Nut Washer . . . . .	.15
Thumb Attachment . . . . .	.20

Each of the above packed two in a box.

Firm-Joint Calipers, Outside and Inside

TEMPERED

**821****Outside****822****Inside**

No.	Size, Inches	Price	No.	Size, Inches	Price
821	3	\$0.50	822	3	\$0.50
	4	.60		4	.60
	5	.70		5	.70
	6	.80		6	.80
	8	1.00		8	1.00
	10	1.10		10	1.10
	12	1.20		12	1.20
	14	1.80		14	1.80
	16	2.10		16	2.10
	18	2.55		18	2.55
	20	3.00		20	3.00
	24	3.60		24	3.60

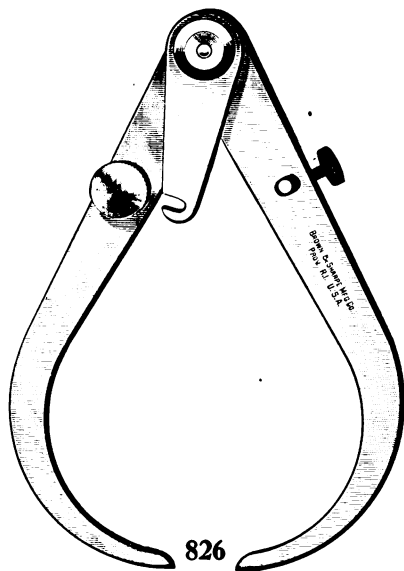
Sizes above refer to length of leg. Actual capacities are as follows:

Size	3	4	5	6	8	10	12	14	16	18	20	24
Actual Capacity of Outside Calipers .	3 1-2	4 1-2	6	7	9 1-2	12	15	17	19	22	24 1-2	29 1-2

Each of the above packed as follows; 3", 4", 5" and 6", six; 8", 10" and 12", four; 14" and 16", two; 18", 20" and 24", one in a box.

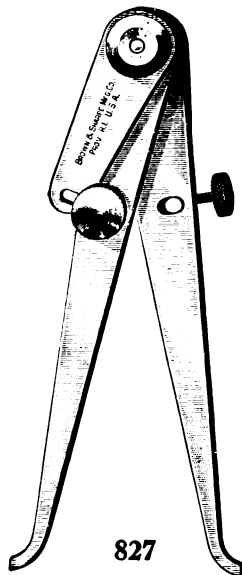
Transfer Firm-Joint Calipers

TEMPERED



826

Outside



827

Inside

No.	Size, Inches	Price	No.	Size, Inches	Price
826	4	\$1.30	827	4	\$1.30
	5	1.50		5	1.50
	6	1.60		6	1.60
	8	1.90		8	1.90
	10	2.20		10	2.20
	12	2.50		12	2.50
	14	2.80		14	2.80
	16	3.10		16	3.10
	18	3.40		18	3.40
	20	4.00		20	4.00
	24	4.90		24	4.90

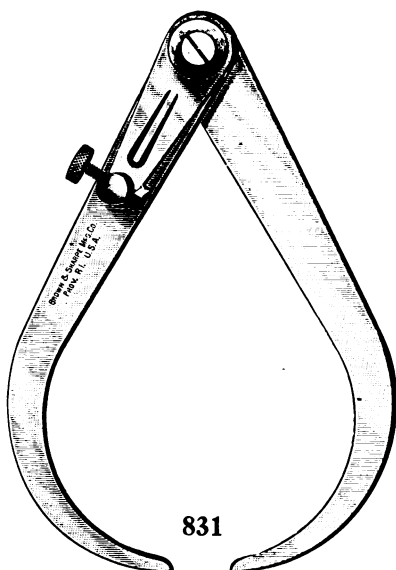
Sizes above refer to length of leg. Actual capacities are as follows:

Size	4	5	6	8	10	12	14	16	18	20	24
Actual Capacity of Outside Calipers . . .	Inches 4 1-2	6	7	9 1-2	12	15	17	19	22	24 1-2	29 1-2

Each of the above packed as follows: 4", 5" and 6", six; 8", 10" and 12", four; 14" and 16", two; 18", 20" and 24", one in a box.

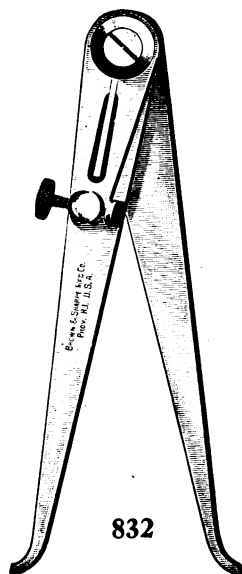
Screw Adjusting Firm-Joint Calipers

TEMPERED



831

Outside



832

Inside

No.	Size, Inches	Price	No.	Size, Inches	Price
831	4	\$1.10	832	4	\$1.10
	5	1.15		5	1.15
	6	1.20		6	1.20
	8	1.50		8	1.50
	10	1.80		10	1.80
	12	2.10		12	2.10
	14	2.40		14	2.40
	16	2.70		16	2.70
	18	3.00		18	3.00
	20	3.30		20	3.30
	24	4.20		24	4.20

Sizes above refer to length of leg. Actual capacities are as follows:

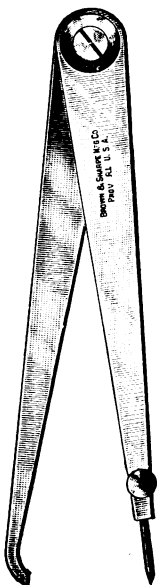
Size	Inches	4	5	6	8	10	12	14	16	18	20	24
Actual Capacity of Outside Calipers .	Inches	4 1-2	6	7	9 1-2	12	15	17	19	22	24 1-2	29 1-2

Each of the above packed as follows: 4", 5" and 6", six; 8", 10" and 12", four; 14" and 16", two; 18", 20" and 24", one in a box.

Firm-Joint Hermaphrodite Calipers No. 835

TEMPERED

No.	Size, Inches	Price with Adjustable Point	Price with Solid Point
835	4	\$0.80	\$0.60
	6	1.00	.80
	8	1.20	1.00



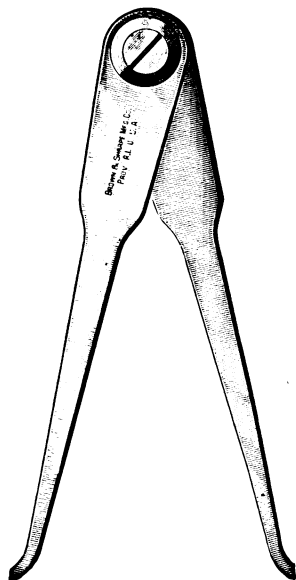
Narrow Firm-Joint Caliper No. 837

TEMPERED

Price, \$0.70

Similar in design to the regular 4" Firm-Joint Caliper, excepting that the legs are much narrower and allow it to be used to measure the diameter of deep holes at the bottom.

It can be inserted 2 1-2" in a hole 1-4" in diameter.



Each of the above packed six in a box, except 8", which are packed four in a box.

Combination Caliper and Divider

No. 840

10 Inch



The arms or holders are provided with split chucks to receive the auxiliary legs, which are held firmly by a turn of the knurled nut that closes the chuck concentrically. A pencil can be substituted for one of the legs if desired.

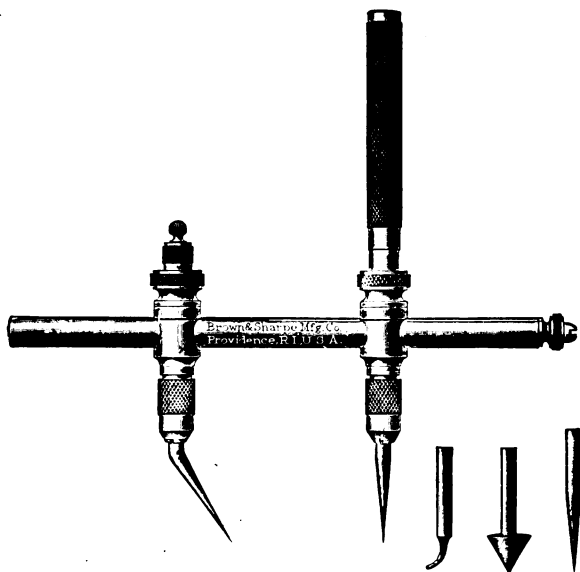
This tool is of steel, carefully finished, and sharp corners are practically eliminated.

Prices

Set Complete	\$3.60
With Divider Legs only	2.40

Packed one in a box.

Universal Divider No. 843



Price, \$6.00

Many points of excellence in design and construction will be noted in this divider.

The scriber point holder has both fine and quick adjustment; the fine adjustment is obtained by a screw, enclosed in the beam, which engages the nut on the scriber point holder. By pulling up the small knurled knob, at top of post, the screw is released and the post can be quickly adjusted; this knob springs into place as soon as released.

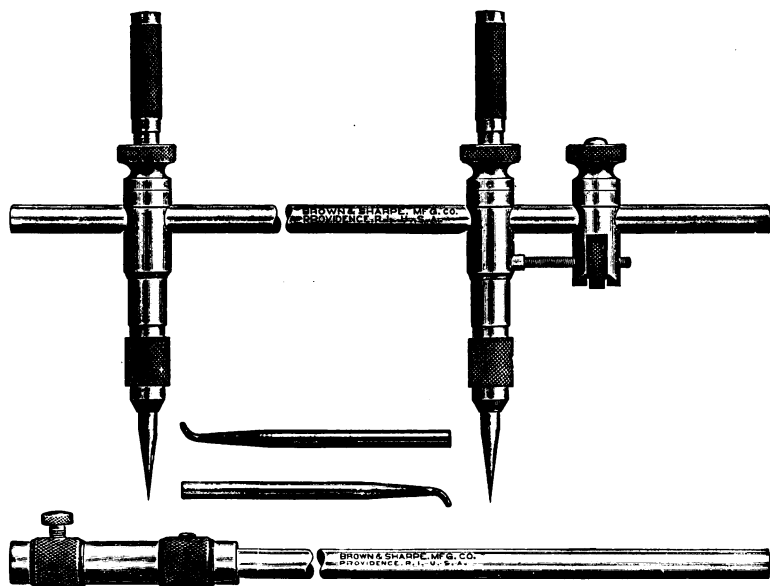
The scriber point is adjustable either side of the centre, and can be set for scribing small circles or for working close to a shoulder. The adjustable centre point is held by a spring chuck and can be easily removed and replaced by a pencil or other special point. The posts are clamped by knurled nuts and held in place by spring friction when the nuts are unclamped for setting the points.

A V point is furnished for use in describing a circle about a hole already drilled. A caliper point is also included.

The beam is 4" long and the points can be set to describe a circle 8" in diameter.

Packed one in a box.

Improved Steel Beam Trammels No. 845



Price,	with 9" Beam,	\$6.00
	Will describe a circle 18" in diam.	
Price,	with 13" Beam,	\$6.00
	Will describe a circle 26" in diam.	
Price,	with 13" Beam and Extension,	\$7.00
	Will describe a circle 54" in diam.	

The trams are clamped by knurled nuts to the beam, which is flattened on top, and the thrust taken by washers to prevent marring the bearing surfaces. A spring friction holds the trams in place when the nuts are loosened for setting. One tram has an adjusting screw and slide, which is convenient for fine adjustment of the points.

A swivel handle at the top of each tram is a noticeable advantage, as it enables the trammels to be much more conveniently and accurately used than is possible with fixed handles. The adjustable points are held by spring chucks and can be easily removed and replaced by pencil or other special points.

A pair of caliper points is furnished with these trammels.

A pair of V points, by the use of which circles may be described around holes from 1-4" to 1 5-8" in diameter, can be furnished for the 13" trammel if desired.

Price, \$1.50 extra.

Packed one in a box.

Set of Standard Tools No. 847

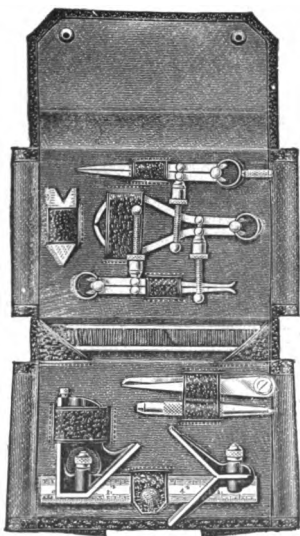
FOR STUDENTS AND APPRENTICES

847



Price, \$9.25

A set of tools that the experience of the shop man has proved to be essential equipment of the beginner.



It is neatly arranged in a folding leather case as shown in the cuts. Size folded, about 7" x 4 3-4" x 1 3-8"

Contains the following tools:

- No. 300 — 6" Tempered Steel Rule, No. 4 Graduation.
- No. 402 — 6" Combination Square, No. 4 Graduation, (with drop-forged heads).
- No. 650 — 60° Centre Gauge.
- No. 765 — 9-64" Centre Punch.
- No. 810 — 4" Rex Divider, solid nut.
- No. 811 — 4" Rex Outside Caliper, solid nut.
- No. 812 — 4" Rex Inside Caliper, solid nut.
- No. 835 — 4" Hermaphrodite Caliper, solid point.

Packed one set in a box.

Set of Standard Tools No. 849

FOR STUDENTS AND APPRENTICES

Contains the following tools:

No. 300 — 6" Tempered Steel Rule,
No. 4 Graduation.

No. 402 — 6" Combination Square,
No. 4 Graduation
(with drop-forged
heads).

No. 650 — 60° Centre Gauge.

No. 765 — Centre Punch (9-64" at
top of tapered point).

No. 810 — 5" Rex Divider, solid
nut.

No. 811 — 6" Rex Outside Caliper,
solid nut.

No. 812 — 6" Rex Inside Caliper,
solid nut.

"Handbook for Apprenticed Ma-
chinists"

Price, \$10.00

Furnished in a nicely finished
wooden box.

The "Handbook for Appren-
ticed Machinists" included with the

set, contains many useful hints and instructions in the proper way to per-
form a large variety of operations common to machine shop practice.

Gas Heater No. 850

FOR TEMPERING DRILLS, PUNCHES, CHISELS, SMALL
TOOLS, ETC.



Price, \$1.50

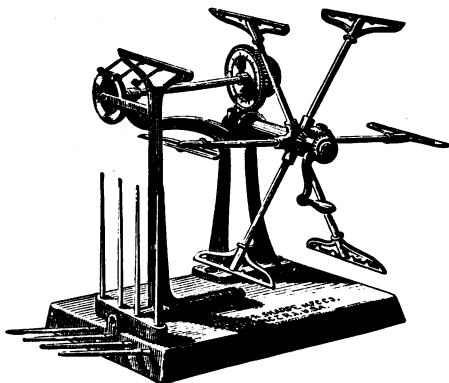
This Heater, in many instances, takes the place of a forge in tempering
machinists' small tools and is more convenient and economical in time and
fuel. It is provided with a collar with holes corresponding to those in the
lower part of the tube. By this arrangement the supply of air can be
regulated and the intensity of the flame controlled.

849

850

Yarn Reel No. 975

FOR REELING AND MEASURING LENGTHS OF COTTON,
WOOLEN AND WORSTED YARNS



Price, \$52.00

The cut illustrates a Yarn Reel especially adapted to accurate reeling of fine yarns. It is used in connection with roving scales and yarn testers when obtaining the stretch, strength and number of cotton, woollen and worsted yarns.

The reels are made with four or seven spindles and in two sizes, 36" and 54" in circumference.

The dial of the 36" reel is graduated into 80 parts, that of the 54" reel is graduated into 120 parts, indicating the number of yards reeled from each spindle. The yarn guides and spindles are kept in line with each other while feeding yarn upon the reel, which is very desirable when reeling fine yarns. The extra length of yarn guides is of use in increasing the friction upon the yarn by taking a half turn or more of yarn around them. The automatic feed motion lays the yarn flat upon the reel, thus securing accurate and uniform measurement and consequently correct results as to stretch, strength and numbering.

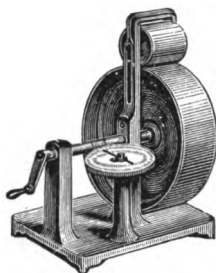
The bright spot on the web of the worm wheel is to show when the zero upon the dial approaches the index point, and thus assists the operator to stop promptly on the striking of the bell.

Printed tables are sent for use in connection with this reel, for numbering cotton, linen, woollen and worsted yarns.

Roving Reel No. 977

TO ACCOMPANY THE ROVING OR YARN SCALES

977



Price, \$30.00

For reeling small quantities of roving, drawing and yarn and also to determine the number of twist in yarn.

Circumference of large drum, 18".

Instructions for Use with the Yarn Reel

To Find Number of Cotton Yarn. Reel and weigh any convenient number of yards. Multiply number of yards reeled by 8 1-3, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of hanks in a pound avoirdupois.

To Find Number of Linen Yarn. Reel and weigh any convenient number of yards. Multiply number of yards reeled by 23 1-3, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of leas in a pound avoirdupois.

To Find Number of Worsted Yarn. Reel and weigh any convenient number of yards. Multiply number of yards reeled by 12 1-2, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of hanks in a pound avoirdupois.

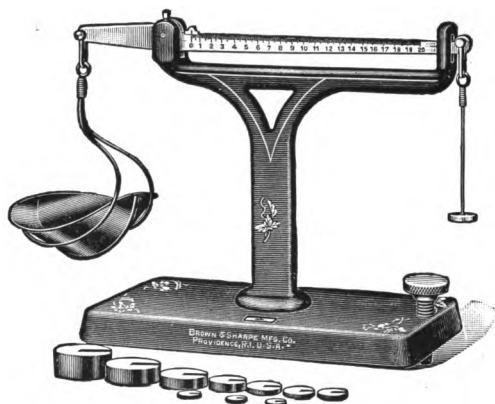
To Find Number of Woolen Yarn. Reel and weigh any convenient number of yards. Multiply number of yards reeled by 4 3-8, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of runs in a pound avoirdupois.

Note. In all of above calculations, the longer the length of yarn taken the more accurate the result will be.

Improved Roving or Yarn Scales

No. 980

For Accurate Weighing



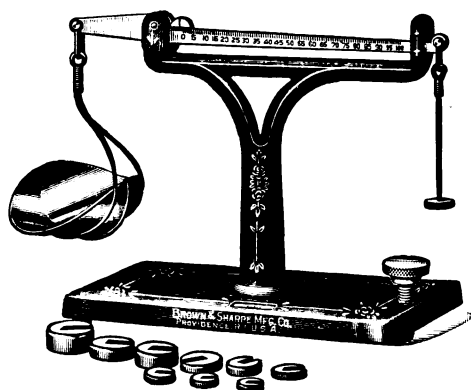
Price, \$19.00

These scales will weigh one pound by tenths of grains or one seventy-thousandth part of one pound avoirdupois, rendering them especially well adapted for use in connection with Yarn Reels, for the numbering of yarn from the weight of hank, giving the weight in tenths of grains to compare with tables. They are also useful for the weighing of any small articles, colors, drugs, etc., for computation of large quantities or for postal scales. The finished parts are nickel-plated and the stand, japanned and ornamented. A spirit level is placed in centre of base for the purpose of setting the scales true on a bench or table. Ten balancing weights accompany each scale, viz.: One each of 20, 30, 50, 100, 200, 300, 500, 1000, 2000 and 3000 grains; the 20 grains on the beam being each divided into 10 parts.

One pound avoirdupois	=	7000	grains
1-2 " "	=	3500	"
1-4 " "	=	1750	"
1-8 " "	=	875	"
One ounce	=	437-5	"

Sample Weighing Scales No. 982

ENGLISH OR METRIC



Price, \$19.00

Adapted for weighing small articles, screws, samples of paper, color, drugs, etc., for the purpose of computing large quantities. They also answer as postal scales. The finished parts are all nickel-plated, and the stand is japanned and ornamented. A spirit level is placed in centre of base, for the purpose of setting the scales true on a bench or table.

English. Weigh to one pound by ten-thousandths of a pound. Nine balancing weights are furnished of the following weights: 100, 200, 400, 800, 1000, 2000, 2000, 4000 ten-thousandths and a one-ounce weight for postal weighing.

Metric. Also made to weigh by Metric system by hundredths of a gramme. Ten balancing weights are furnished of the following weights: 1, 2, 5, 10, 20, 40, 60, 100, 100 and 200 grammes.

7000 grains equal one pound avoirdupois.

One	ten-thousandth	of a pound	equals	7-10	of a grain.
156	1-4	ten-thousandths	" " "	equal	1-4 of an ounce.
312	1-2	"	" " "	"	1-2 " " "
468	3-4	"	" " "	"	3-4 " " "
625	"	"	" " "	"	1 ounce
2500	"	"	" " "	"	1-4 of a pound
5000	"	"	" " "	"	1-2 " " "
7500	"	"	" " "	"	3-4 " " "

982

Brown & Sharpe Hair Clippers

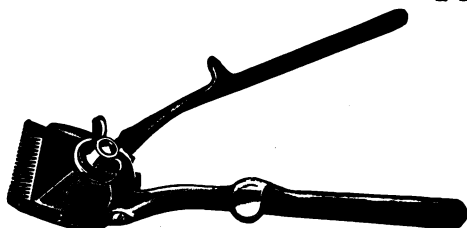
Brown & Sharpe Hair Clippers are simple, durable, powerful, clean-cutting and convenient.

The handles fit the natural grip of the hand, and the weight of the parts is so distributed that the clippers are particularly well-balanced.

They have a clean, powerful cutting action, are easily adjusted and taken apart and with ordinary care should last a lifetime, the plates being thick enough to permit repeated sharpening.

The spring is practically indestructible and its tension is uniform through the length of the stroke.

Nos. 000 and 00 Hair Clippers



These are narrow clippers especially useful in clipping about the neck or for trimming the beard.

No. 000. To cut hair very short, about equal to shaving \$6.00

No. 00. To cut hair one-thirty-second of an inch long 6.00

"Bressant" Hair Clippers



"BRESSANT" — Trade Mark

The Bressant Clippers differ from Nos. 00 and 000 in that the cutting action is actuated by a spiral spring contained within a screw shell. There is also a slight variation in the shape of these clippers, the weight and balance being slightly different from the latter. The washer is attached to the winged nut as a convenience, and to prevent it being lost if dropped.

No. 0 To cut hair one-thirty-second of an inch long \$6 00

No. 1 To cut hair one-eighth of an inch long 6.00

No. 2 To cut hair one-quarter of an inch long 6.50

No. 3 To cut hair five-sixteenths of an inch long 7.00

Brown & Sharpe Tapers (Continued)

No. of Taper	Diam. of Plug at Small End	Plug Depth			Keyway from End of Spindle	Shank Depth	Length of Keyway +	Width of Keyway	Length of Arbor Tongue	Diameter of Arbor Tongue	Thickness of Arbor Tongue	Radius of Tongue Circle	Radius of Tongue at a	Limit for Tongue to project thro' Test Tool
		B & S* Standard	Mill Mach. Standard	Miscell.										
	D				K	S	L	W	T	d	t	c	a	
9	.900		4		3½	4½	1½	.385	⅞	.860	½	⅞	.100	.005
		4½			4½	4½	1½	.385	⅞	.860	½	⅞	.100	.005
		5			4½	5½	1⅞	.447	⅞	1.010	⅞	⅞	.110	.005
10	1.0446		5½		5½	6½	1⅞	.447	⅞	1.010	⅞	⅞	.110	.005
				6½	6½	6½	1⅞	.447	⅞	1.010	⅞	⅞	.110	.005
11	1.250	5½			5½	6½	1⅞	.447	⅞	1.210	⅞	½	.130	.005
			6½		6½	7½	1⅞	.447	⅞	1.210	⅞	½	.130	.005
12	1.500	7½	7½		6½	7½	1½	.510	½	1.460	½	½	.150	.005
				6½										
13	1.750	7½			7⅞	8⅞	1½	.510	½	1.710	½	½	.170	.010
14	2.00	8½	8½		8⅞	9⅞	1½	.572	⅞	1.960	⅞	½	.190	.010
15	2.25	8½			8½	9½	1½	.572	⅞	2.210	⅞	½	.210	.010
16	2.50	9½			9	10½	1½	.635	⅞	2.450	½	1	.230	.010
17	2.75	9½												
18	3.00	10½												

The Jarno Taper

Taper per Foot = 0.6 Inch. Taper per Inch = 0.05 Inch

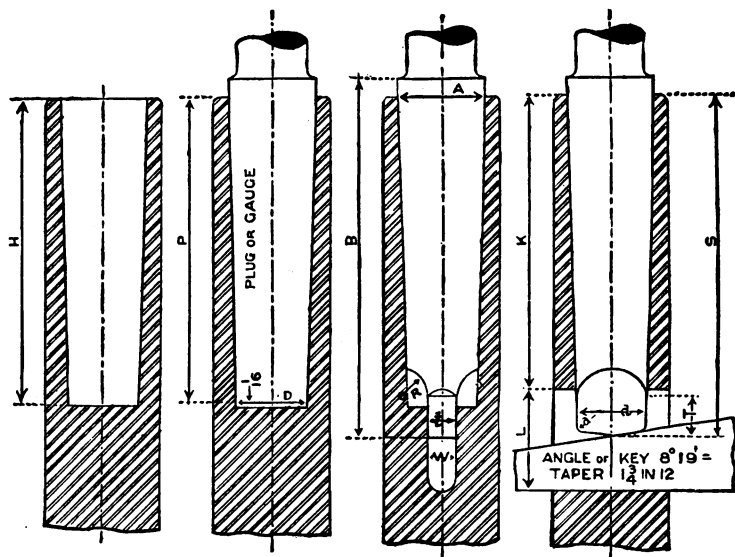
$$\text{Diam. Large End} = \frac{\text{No. of Taper}}{8}$$

$$\text{Diam. Small End} = \frac{\text{No. of Taper}}{10}$$

$$\text{Length of Taper} = \frac{\text{No. of Taper}}{2}$$

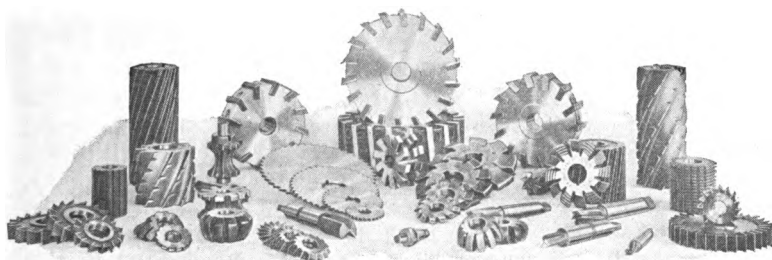
While the majority of American tool builders use the Brown & Sharpe taper in their milling-machine spindles and the Morse taper in their lathes, a number of firms have adopted the "Jarno" taper. In this system the taper of which is 0.6 inch per foot or 1 in 20, the number of the taper is the key by which all the dimensions are immediately determined. That is the number of the taper is the number of tenths of an inch in diameter at the small end, the number of eighths of an inch at the large end, and the number of halves of an inch in length or depth. For example: the No. 6 taper is six-eighths (¾) inch diameter at large end, six-tenths (⅖) diameter at the small end and six halves (3) inches in length. Similarly, the No. 16 taper is 16-8, or 2 inches diameter at the large end; 16-10 or 1.6 inches at the small end; 16-2 or 8 inches in length.

Morse Tapers



Number of Taper	Diam. of Plug at Small End, Inches	Diam. at End of Socket, Inches	SHANK		Depth of Hole, Inches	Standard Plug Depth, Inches	TONGUE					KEYWAY			Taper per Foot	Taper per Inch	Number of Key
			Whole Length of Shank, Inches	Shank Depth, Inches			Thickness of Tongue, Inches	Length of Tongue, Inches	Rad. of Mill for Tongue, Inches	Diameter of Tongue, Inches	Radius of Tongue, Inches	Width of Keyway, Inches	Length of Keyway, Inches	End of Socket to Keyway, Inches			
	D	A	B	S	H	P	t	T	R	d	a	W	L	K			
0	.252	.3561	2 $\frac{1}{2}$	2 $\frac{1}{8}$	2 $\frac{1}{8}$	2	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	.235	.04	.160	$\frac{1}{8}$	1 $\frac{1}{2}$	.625	.05208	0
1	.369	.475	2 $\frac{3}{4}$	2 $\frac{3}{8}$	2 $\frac{3}{8}$	2 $\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	.343	.05	.213	$\frac{1}{4}$	2 $\frac{1}{8}$	.600	.05	1
2	.572	.700	3 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	.06	.06	.260	$\frac{1}{2}$	2 $\frac{1}{2}$	.602	.05016	2
3	.778	.938	3 $\frac{3}{4}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	.08	.08	.322	1 $\frac{1}{4}$	3 $\frac{1}{4}$	.602	.05016	3
4	1.020	1.231	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	.10	.10	.478	1 $\frac{1}{2}$	3 $\frac{1}{2}$	.623	.05191	4
5	1.475	1.748	6 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	1 $\frac{1}{2}$	.12	.12	.635	1 $\frac{1}{2}$	4 $\frac{1}{2}$	.630	.0525	5
6	2.116	2.494	8 $\frac{1}{4}$	8 $\frac{1}{4}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$	$\frac{1}{2}$	1 $\frac{1}{2}$	2	.15	.15	.760	1 $\frac{1}{2}$	7	.626	.05216	6
7	2.750	3.270	11 $\frac{1}{2}$	11 $\frac{1}{2}$	10 $\frac{1}{2}$	10	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2 $\frac{1}{2}$	.18	.18	1.135	2 $\frac{1}{2}$	9 $\frac{1}{2}$	.625	.05208	7

Cutters



WE now regularly manufacture and usually carry in stock 45 varieties of cutters, and we can make any size or shape or arrange for any combination of cutters that may be desired.

Our Cutter Department is equipped with special machinery and many appliances that are the outgrowth of over 50 years' experience in the manufacture of this class of tools.

Stocks of our regular cutters are carried by the leading hardware dealers throughout the country and can usually be purchased most advantageously from the dealers. It is also frequently advantageous to order special cutters through the dealers.

Keep Cutters Sharpened Properly. A dull cutter wears very rapidly and does poor work. As soon as there is any appearance of dullness in a cutter, pass it once or twice across a grinding wheel, which should be mounted upon a suitably designed machine. This in the long run will save time in sharpening, prolong the life of the cutters, and enable them to do their best and most rapid work. Formed cutters should have their teeth ground radially and so that they are all of the same height. Further information on page 248.

Lubricant. With all of our cutters lubricant should be freely used when milling Wrought Iron or Steel. Lard oil is usually the best; but in many cases the following Soda-Water mixture answers very well and is less expensive:

One-quarter pound Sal-Soda. One-half pint Lard Oil. One-half pint Soft Soap. Water enough to make ten quarts. Boil one-half hour.

The Advantages of Coarse-Tooth Milling Cutters

IN the development of Coarse-Tooth Milling Cutters, the aim has been to obtain the freest possible cutting action without impairing the accuracy of the surface produced. The new cutters with wide-spaced teeth have a marked advantage, on many classes of work, over the usual types, being capable of removing a considerably greater quantity of metal in a given time, without distressing the cutter or overloading the machine.

The free cutting action of coarse-tooth cutters is largely due to the fact that less cutting is actually required to remove a given amount of metal, each tooth taking a large, deep chip. This results in a considerable decrease in the tendency to slide over the surface and spring the cutter arbor. The rake and increased spiral of the teeth give a more nearly perfect shearing, rather than a pushing or dragging action. Accordingly there is less friction generated for a given cut, leaving the teeth much cooler and causing them to do considerably more work between grindings.

A marked advantage arising from the free cutting action is the consumption of less power, as might be expected from the fact that there is less friction and heating.

The wide spaces between the teeth allow the cutting edges to be well backed up, which was not always possible with closely spaced teeth. This increase in the strength of the teeth is much greater in proportion than the increase in work done by each tooth in removing the larger chips. Therefore the cutters are well prepared to handle deep and rapid cuts without danger of failing.

The main advantage of coarse-tooth milling cutters may then be stated as increased production and decreased power consumption, due to the heavier cuts taken and the freer cutting action. Of course, the amount of improvement in these points differs greatly in various instances, owing to the conditions, such as the stiffness of the work, nature of the cut, strength of the machine, etc.

In developing the line of Brown & Sharpe Coarse-Tooth Milling Cutters particular attention has been given to the angle of rake and the lead of the spiral of the teeth. After a long series of practical experiments we have adopted the present type with steep spiral and considerable angle of rake as the most economical and practical form.

Clearance on Cutters

WHEN sharpening cutters, the clearance should always be taken into consideration. Clearance, or relief, on milling cutters is the amount of material removed from the top of the teeth back of the cutting edge, to permit the teeth to clear the stock and not scrape over it after the cutting edge has done its work. On formed and gear cutters, clearance does not have to be considered in re-sharpening, because the teeth are so formed that when ground radially on the faces the clearance remains the same.

The angle of clearance depends upon the diameter of the cutters and must be greater for small cutters than for large ones. The clearance on the teeth of plain milling cutters should be 4 degrees for cutters over 3 inches in diameter, and 6 degrees for those under 3 inches, and the land at the top of the teeth should be from .02 to .04 inch wide before the clearance is cut or ground. The clearance of the end teeth of end mills should be about 2 degrees, and it is well to have the teeth a little hollowing, letting them be .001 or .002 inch lower near the centre than at the outside, so that the inner ends of the teeth will not drag on the work. This can be done by setting the swivel on the cutter grinder slightly away from 90 degrees. If the clearance of a cutter is too great, vibrations are likely to occur in operation, and this is something that should be prevented by all means.

See Cutter Clearance Gauge on page 352.

Feeds and Speeds

THE Feeds and Speeds of cutters cannot be governed by any definite rules, but, in a general way, the following surface speeds will serve to give an idea, or basis, to work from. They may be varied slightly to suit the requirements of the work in hand. Using Carbon Steel Cutters: For brass, 80 feet to 100 feet per minute; for cast iron, 40 feet to 60 feet per minute; for machinery steel, 30 feet to 40 feet per minute; and for annealed tool steel, 20 feet to 30 feet per minute have been found satisfactory. With High-Speed Steel Cutters for the same materials, the following speeds are advocated: For brass, 150 feet to 200 feet per minute; for cast iron, 80 feet to 100 feet per minute; for machinery steel, 80 feet to 100 feet per minute; and for annealed tool steel, 60 feet to 80 feet per minute.

Tables for determining the number of revolutions per minute to obtain the more common surface speeds of cutters of different diameters will be found on pages 206 and 207.

Table of Cutting Speeds

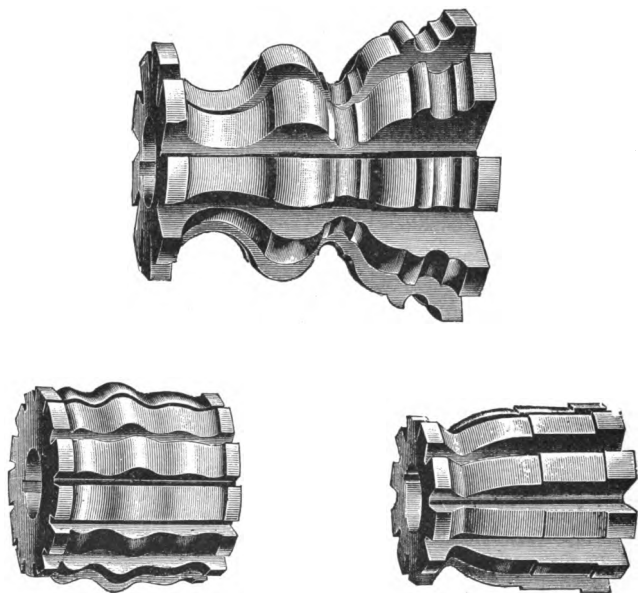
Feet per Minute	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55
Diam., Inches	REVOLUTIONS PER MINUTE											
1-16	917	1070	1222	1375	1528	1681	1833	2139	2445	2750	3056	3361
1-8	458	535	611	688	764	840	917	1070	1222	1375	1528	1681
3-16	306	357	407	458	509	560	611	713	815	917	1019	1120
1-4	229	267	306	344	382	420	458	535	611	688	764	840
5-16	183	214	244	275	306	336	367	428	489	550	611	672
3-8	153	178	204	229	255	280	306	357	407	458	509	560
7-16	131	153	175	196	218	240	262	306	349	393	437	480
1-2	115	134	153	172	191	210	229	267	306	344	382	420
5-8	91.7	107	122	138	153	168	183	214	244	275	306	336
3-4	76.4	89.1	102	115	127	140	153	178	204	229	255	280
7-8	65.5	76.4	87.3	98.2	109	120	131	153	175	196	218	240
1	57.3	66.8	76.4	85.9	95.5	105	115	134	153	172	191	210
1 1-8	50.9	59.4	67.9	76.4	84.9	93.4	102	119	136	153	170	187
1 1-4	45.8	53.5	61.1	68.8	76.4	84.0	91.7	107	122	138	153	168
1 3-8	41.7	48.6	55.6	62.5	69.5	76.4	83.3	97.2	111	125	139	153
1 1-2	38.2	44.6	50.9	57.3	63.7	70.0	76.4	89.1	102	115	127	140
1 5-8	35.3	41.1	47.0	52.9	58.8	64.6	70.5	82.3	94.0	106	118	129
1 3-4	32.7	38.2	43.7	49.1	54.6	60.0	65.5	76.4	87.3	98.2	109	120
1 7-8	30.6	35.7	40.7	45.8	50.9	56.0	61.1	71.3	81.5	91.7	102	112
2	28.7	33.4	38.2	43.0	47.7	52.5	57.3	66.8	76.4	85.9	95.5	105
2 1-4	25.5	29.7	34.0	38.2	42.4	46.7	50.9	59.4	67.9	76.4	84.9	93.4
2 1-2	22.9	26.7	30.6	34.4	38.2	42.0	45.8	53.5	61.1	68.8	76.4	84.0
2 3-4	20.8	24.3	27.8	31.3	34.7	38.2	41.7	48.6	55.6	62.5	69.5	76.4
3	19.1	22.3	25.5	28.6	31.8	35.0	38.2	44.6	50.9	57.3	63.7	70.0
3 1-4	17.6	20.6	23.5	26.4	29.4	32.3	35.3	41.1	47.0	52.9	58.8	64.6
3 1-2	16.4	19.1	21.8	24.5	27.3	30.0	32.7	38.2	43.7	49.1	54.6	60.0
3 3-4	15.3	17.8	20.4	22.9	25.5	28.0	30.6	35.7	40.7	45.8	50.9	56.0
4	14.3	16.7	19.1	21.5	23.9	26.3	28.7	33.4	38.2	43.0	47.7	52.5
4 1-2	12.7	14.9	17.0	19.1	21.2	23.3	25.5	29.7	34.0	38.2	42.4	46.7
5	11.5	13.4	15.3	17.2	19.1	21.0	22.9	26.7	30.6	34.4	38.2	42.0
5 1-2	10.4	12.2	13.9	15.6	17.4	19.1	20.8	24.3	27.8	31.3	34.7	38.2
6	9.5	11.1	12.7	14.3	15.9	17.5	19.1	22.3	25.5	28.6	31.8	35.0
6 1-2	8.8	10.3	11.8	13.2	14.7	16.2	17.6	20.6	23.5	26.4	29.4	32.3
7	8.2	9.5	10.9	12.3	13.6	15.0	16.4	19.1	21.8	24.5	27.3	30.0
7 1-2	7.6	8.9	10.2	11.5	12.7	14.0	15.3	17.8	20.4	22.9	25.5	28.0
8	7.2	8.4	9.5	10.7	11.9	13.1	14.3	16.7	19.1	21.5	23.9	26.3
8 1-2	6.7	7.9	9.0	10.1	11.2	12.4	13.5	15.7	18.0	20.2	22.5	24.7
9	6.4	7.4	8.5	9.5	10.6	11.7	12.7	14.9	17.0	19.1	21.2	23.3
9 1-2	6.0	7.0	8.0	9.1	10.1	11.1	12.1	14.1	16.1	18.1	20.1	22.1
10	5.7	6.7	7.6	8.6	9.5	10.5	11.5	13.4	15.3	17.2	19.1	21.0
11	5.2	6.1	6.9	7.8	8.7	9.5	10.4	12.2	13.9	15.6	17.4	19.1
12	4.8	5.6	6.4	7.2	8.0	8.8	9.5	11.1	12.7	14.3	15.9	17.5
13	4.4	5.1	5.9	6.6	7.3	8.1	8.8	10.3	11.8	13.2	14.7	16.2
14	4.1	4.8	5.5	6.1	6.8	7.5	8.2	9.5	10.9	12.3	13.6	15.0
15	3.8	4.5	5.1	5.7	6.4	7.0	7.6	8.9	10.2	11.5	12.7	14.0
16	3.6	4.2	4.8	5.4	6.0	6.6	7.2	8.4	9.5	10.7	11.9	13.1
17	3.4	3.9	4.5	5.1	5.6	6.2	6.7	7.9	9.0	10.1	11.2	12.4
18	3.2	3.7	4.2	4.8	5.3	5.8	6.4	7.4	8.5	9.5	10.6	11.7
Feet per Minute	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55

Table of Cutting Speeds (Continued)

Feet per Minute	60	65	70	75	80	90	100	110	120	130	140	150
Diam., Inches	REVOLUTIONS PER MINUTE											
1-16	3667	3973	4278	4584	4889	.....	.....	.....	.....	.....	.....	.....
1-8	1833	1986	2139	2292	2445	2750	3056	3361	3667	3973	4278	4584
3-16	1222	1324	1426	1528	1630	1833	2037	2241	2445	2648	2852	3056
1-4	917	993	1070	1146	1222	1375	1528	1681	1833	1986	2139	2292
5-16	733	794	856	917	978	1100	1222	1345	1467	1589	1711	1833
3-8	611	662	713	764	815	917	1019	1120	1222	1324	1426	1528
7-16	524	568	611	655	698	786	873	960	1048	1135	1222	1310
1-2	458	497	535	573	611	688	764	840	917	993	1070	1146
5-8	367	397	428	458	489	550	611	672	733	794	856	917
3-4	306	331	357	382	407	458	509	560	611	662	713	764
7-8	262	284	306	327	349	393	437	480	524	568	611	655
1	229	248	267	287	306	344	382	420	458	497	535	573
1 1-8	204	221	238	255	272	306	340	373	407	441	475	509
1 1-4	183	199	214	229	244	275	306	336	367	397	428	458
1 3-8	167	181	194	208	222	250	278	306	333	361	389	417
1 1-2	153	166	178	191	204	229	255	280	306	331	357	382
1 5-8	141	153	165	176	188	212	235	259	282	306	329	353
1 3-4	131	142	153	164	175	196	218	240	262	284	306	327
1 7-8	122	132	143	153	163	183	204	224	244	265	285	306
2	115	124	134	143	153	172	191	210	229	248	267	287
2 1-4	102	110	119	127	136	153	170	187	204	221	238	255
2 1-2	91.7	99.3	107	115	122	138	153	168	183	199	214	229
2 3-4	83.3	90.3	97.2	104	111	125	139	153	167	181	194	208
3	76.4	82.8	89.1	95.5	102	115	127	140	153	166	178	191
3 1-4	70.5	76.4	82.3	88.2	94.0	106	118	129	141	153	165	176
3 1-2	65.5	70.9	76.4	81.9	87.3	98.2	109	120	131	142	153	164
3 3-4	61.1	66.2	71.3	76.4	81.5	91.7	102	112	122	132	143	153
4	57.3	62.1	66.8	71.6	76.4	85.9	95.5	105	115	124	134	143
4 1-2	50.9	55.2	59.4	63.6	67.9	76.4	84.9	93.4	102	110	119	127
5	45.8	49.7	53.5	57.3	61.1	68.8	76.4	84.0	91.7	99.3	107	115
5 1-2	41.7	45.1	48.6	52.1	55.6	62.5	69.5	76.4	83.3	90.3	97.2	104
6	38.2	41.4	44.6	47.8	50.9	57.3	63.7	70.0	76.4	82.8	89.1	95.5
6 1-2	35.3	38.2	41.1	44.1	47.0	52.9	58.8	64.6	70.5	76.4	82.3	88.2
7	32.7	35.5	38.2	40.9	43.7	49.1	54.6	60.0	65.5	70.9	76.4	81.9
7 1-2	30.6	33.1	35.7	38.2	40.7	45.8	50.9	56.0	61.1	66.2	71.3	76.4
8	28.7	31.0	33.4	35.8	38.2	43.0	47.7	52.5	57.3	62.1	66.8	71.6
8 1-2	27.0	29.2	31.5	33.7	36.0	40.4	44.9	49.4	53.9	58.4	62.9	67.4
9	25.5	27.6	29.7	31.8	34.0	38.2	42.4	46.7	50.9	55.2	59.4	63.6
9 1-2	24.1	26.1	28.2	30.2	32.2	36.2	40.2	44.2	48.3	52.3	56.3	60.3
10	22.9	24.8	26.7	28.7	30.6	34.4	38.2	42.0	45.8	49.7	53.5	57.3
11	20.8	22.6	24.3	26.0	27.8	31.3	34.7	38.2	41.7	45.1	48.6	52.1
12	19.1	20.7	22.3	23.9	25.5	28.6	31.8	35.0	38.2	41.4	44.6	47.8
13	17.6	19.1	20.6	22.0	23.5	26.4	29.4	32.3	35.3	38.2	41.1	44.1
14	16.4	17.7	19.1	20.5	21.8	24.5	27.3	30.0	32.7	35.5	38.2	40.9
15	15.3	16.6	17.8	19.1	20.4	22.9	25.5	28.0	30.6	33.1	35.7	38.2
16	14.3	15.5	16.7	17.9	19.1	21.5	23.9	26.3	28.7	31.0	33.4	35.8
17	13.5	14.6	15.7	16.9	18.0	20.2	22.5	24.7	27.0	29.2	31.5	33.7
18	12.7	13.8	14.9	15.9	17.0	19.1	21.2	23.3	25.5	27.6	29.7	31.8
Feet per Minute	60	65	70	75	80	90	100	110	120	130	140	150

Formed Cutters

FOR MILLING SEWING-MACHINE AND GUN PARTS

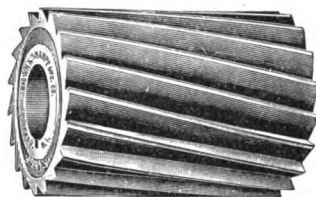
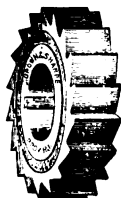


FORMED cutters can be made in a great variety of outlines and can be sharpened by grinding without changing their form.

They are economical in the production of duplicate and interchangeable parts.

In ordering send sketch or sample of piece to be milled, with size of hole required in cutter.

Milling Cutters



Cutters of less than 3-4" face have straight teeth

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
M-10	2 1-4	1-2	7-8	\$2.25	\$2.85
M-11	2 1-4	1	7-8	3.20	4.55
M-12	2 1-4	1 3-4	7-8	4.20	5.80
M-14	2 1-2	3-16	1	1.65	2.10
M-15	2 1-2	1-4	1	1.80	2.30
M-16	2 1-2	5-16	1	2.00	2.55
M-17	2 1-2	3-8	1	2.10	2.65
M-18	2 1-2	7-16	1	2.20	2.80
M-19	2 1-2	1-2	1	2.30	3.00
M-20	2 1-2	9-16	1	2.40	3.20
M-21	2 1-2	5-8	1	2.45	3.45
M-22	2 1-2	11-16	1	2.65	3.55
M-23	2 1-2	3-4	1	2.80	3.80
M-24	2 1-2	13-16	1	2.90	4.00
M-25	2 1-2	7-8	1	3.10	4.15
M-26	2 1-2	1	1	3.30	4.55
M-28	2 1-2	1 1-4	1	3.70	5.15
M-29	2 1-2	1 1-2	1	4.00	5.65
M-30	2 1-2	1 3-4	1	4.35	6.30
M-31	2 1-2	2	1	4.75	6.90
M-33	2 1-2	2 1-2	1	5.25	7.85
M-35	2 1-2	3	1	5.70	8.80
M-37	2 1-2	4	1	7.00	11.00
M-38	2 3-4	3-16	1	1.75	2.20
M-39	2 3-4	1-4	1	2.00	2.50
M-40	2 3-4	5-16	1	2.10	2.70
M-41	2 3-4	3-8	1	2.30	2.90
M-42	2 3-4	7-16	1	2.35	3.20
M-43	2 3-4	1-2	1	2.40	3.30
M-44	2 3-4	9-16	1	2.55	3.55
M-45	2 3-4	5-8	1	2.70	3.90

Other sizes made to order. Prices on application.
For List of Keyways, see page 230.

List continued on next page.

Milling Cutters

(Continued)

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
M-45B	2 3-4	3-4	1	\$3.20	\$4.35
M-45C	2 3-4	7-8	1	3.65	4.95
M-46	2 3-4	1	1	4.00	5.35
M-48	2 3-4	1 1-4	1	4.35	6.10
M-49	2 3-4	1 1-2	1	4.80	6.80
M-51	2 3-4	2	1	5.35	7.95
M-52	2 3-4	2 1-2	1	5.85	9.00
M-53	2 3-4	3	1	6.40	10.00
M-55	2 3-4	4	1 1-4	7.65	12.65
M-61	3	3-16	1	1.75	2.35
M-62	3	1-4	1	2.10	2.75
M-63	3	5-16	1	2.35	3.20
M-63A	3	3-8	1	2.70	3.55
M-64	3	3-8	1 1-4	2.70	3.55
M-65	3	7-16	1 1-4	2.85	3.85
M-66	3	1-2	1 1-4	3.10	4.10
M-67	3	9-16	1 1-4	3.25	4.40
M-68	3	5-8	1 1-4	3.45	4.70
M-70	3	3-4	1 1-4	3.85	5.20
M-71	3	7-8	1 1-4	4.20	5.75
M-72	3	1	1 1-4	4.55	6.35
M-73	3	1 1-4	1 1-4	5.10	7.20
M-74	3	1 1-2	1 1-4	5.45	7.85
M-75	3	1 3-4	1 1-4	5.70	8.45
M-76	3	2	1 1-4	6.00	9.00
M-77	3	2 1-2	1 1-4	6.60	10.35
M-78	3	3	1 1-4	7.00	11.20
M-79	3	3 1-2	1 1-4	7.50	12.50
M-80	3	4	1 1-4	8.15	13.80
M-81	3	5	1 1-4	9.90	16.90
M-82	3	6	1 1-4	13.70	22.15
M-83	3 1-2	3-16	1	1.85	2.65
M-84	3 1-2	1-4	1	2.20	3.10
M-85	3 1-2	5-16	1	2.65	3.65
M-86	3 1-2	3-8	1	3.10	4.25
M-87	3 1-2	7-16	1	3.50	4.40
M-88	3 1-2	1-2	1 1-4	4.00	5.45
M-90	3 1-2	5-8	1 1-4	4.40	6.05
M-92	3 1-2	3-4	1 1-4	4.90	6.80
M-93	3 1-2	7-8	1 1-4	5.55	7.70
M-94	3 1-2	1	1 1-4	6.10	8.25
M-96	3 1-2	1 1-2	1 1-4	7.10	10.00
M-98	3 1-2	2	1 1-4	8.15	12.30

List continued on next page.

For List of Keyways, see page 230.

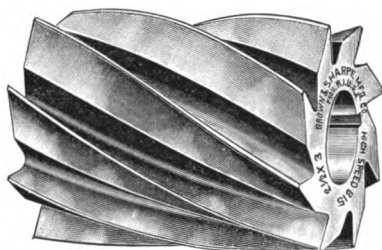
Milling Cutters

(Continued)

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
M-99	3 1-2	2 1-2	1 1-4	\$8.75	\$13.80
M-100	3 1-2	3	1 1-4	9.40	15.35
M-101	3 1-2	3 1-2	1 1-4	10.35	16.70
M-102	3 1-2	4	1 1-4	11.60	19.30
M-102A	3 1-2	4	1 1-2	11.60	19.30
M-104A	4	1-4	1	2.60	3.80
M-105	4	1-4	1 1-4	2.60	3.80
M-104B	4	5-16	1	3.20	4.55
M-106	4	5-16	1 1-4	3.20	4.55
M-104C	4	3-8	1	3.85	5.35
M-107	4	3-8	1 1-4	3.85	5.35
M-108	4	7-16	1 1-4	4.45	6.15
M-109	4	1-2	1 1-4	5.00	6.85
M-111	4	9-16	1 1-4	5.20	7.25
M-112	4	5-8	1 1-4	5.45	7.65
M-114	4	3-4	1 1-4	6.00	8.45
M-116	4	7-8	1 1-4	6.55	9.30
M-117	4	1	1 1-4	7.15	10.25
M-118	4	1	1 1-2	7.15	10.25
M-119	4	1 1-4	1 1-4	7.90	11.60
M-120	4	1 1-4	1 1-2	7.90	11.60
M-121	4	1 1-2	1 1-4	8.40	12.70
M-122	4	1 1-2	1 1-2	8.40	12.70
M-123	4	1 3-4	1 1-4	9.00	13.70
M-124	4	1 3-4	1 1-2	9.00	13.70
M-125	4	2	1 1-4	9.45	14.85
M-126	4	2	1 1-2	9.45	14.85
M-128	4	3	1 1-4	11.45	19.10
M-128A	4	3	1 1-2	11.45	19.10
M-130	4	4	1 1-4	14.00	23.95
M-131	4	4	1 1-2	14.00	23.95
M-133	4	5	1 1-2	17.10	28.95
M-136	4	6	1 1-2	19.65	34.45
M-142	4 1-2	1-2	2	5.10	7.50
M-146	4 1-2	5-8	2	5.60	8.60
M-150	4 1-2	3-4	2	6.10	9.60
M-152	4 1-2	7-8	2	6.70	10.50
M-154	4 1-2	1	2	7.50	11.55
M-156	4 1-2	1 1-4	2	8.60	13.00
M-158	4 1-2	1 1-2	2	9.50	14.60
M-160	4 1-2	1 3-4	2	10.45	16.30
M-162	4 1-2	2	2	10.80	18.00
M-163	4 1-2	6	2	24.70	45.10

For List of Keyways, see page 230.

Coarse-Tooth Plain Milling Cutters



HIGH-SPEED STEEL

See page 204 for explanation of advantages of Coarse-Tooth Cutters.

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price
*M-250	2 1-2	1	1	\$4.55
*M-251	2 1-2	1 1-4	1	5.15
*M-252	2 1-2	1 1-2	1	5.65
*M-253	2 1-2	1 3-4	1	6.30
M-254	2 1-2	2	1	6.90
M-255	2 1-2	2 1-2	1	7.85
M-256	2 1-2	3	1	8.80
M-257	2 1-2	4	1	11.00
*M-258	3	1	1 1-4	6.35
*M-259	3	1 1-4	1 1-4	7.20
*M-260	3	1 1-2	1 1-4	7.85
M-261	3	2	1 1-4	9.00
M-262	3	2 1-2	1 1-4	10.35
M-263	3	3	1 1-4	11.20
M-264	3	4	1 1-4	13.80
M-265	3	5	1 1-4	16.90
M-266	3	6	1 1-4	22.15
*M-267	3 1-2	1	1 1-2	8.25
*M-268	3 1-2	1 1-2	1 1-2	10.00
*M-269	3 1-2	2	1 1-2	12.30
M-270	3 1-2	2 1-2	1 1-2	13.80
M-271	3 1-2	3	1 1-2	15.35
M-272	3 1-2	4	1 1-2	19.30
M-273	3 1-2	5	1 1-2	22.20
M-274	3 1-2	6	1 1-2	26.30
*M-275	4	1	1 1-2	10.25
*M-276	4	1 1-4	1 1-2	11.60
*M-277	4	1 1-2	1 1-2	12.70
*M-278	4	2	1 1-2	14.85
M-279	4	3	1 1-2	19.10
M-280	4	4	1 1-2	23.95
M-281	4	5	1 1-2	28.95
M-282	4	6	1 1-2	34.45

* Made to order only. List of Keyways, page 230.

List continued on next page.

Coarse-Tooth Plain Milling Cutters

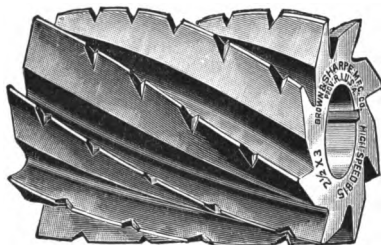
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No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price
*M-283	4 1-2	1	2	\$11.55
*M-284	4 1-2	1 1-4	2	13.00
*M-285	4 1-2	1 1-2	2	14.60
*M-286	4 1-2	2	2	18.00
M-287	4 1-2	3	2	24.30
M-288	4 1-2	4	2	30.75
M-289	4 1-2	5	2	37.85
M-290	4 1-2	6	2	45.10

* Made to order only.

For List of Keyways, see page 230.

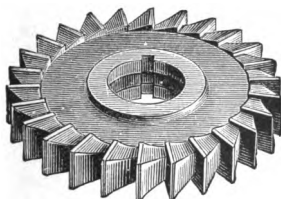
**WITH
NICKED
TEETH**



**HIGH-
SPEED
STEEL**

See page 204 for explanation of advantages of Coarse-Tooth Cutters.

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price
M-301	2 1-2	3	1	\$10.00
M-310	3	4	1 1-4	15.55
M-318	3 1-2	4	1 1-2	21.75
M-321	3 1-2	6	1 1-2	29.60
M-343	4 1-2	4	2	34.30
M-345	4 1-2	6	2	50.15



Side Milling Cutters

These cutters are often used in pairs for sizing nuts, bolt heads, etc., and are then called "Straddle Mills." They have teeth upon both sides and edges.

Cutters having dimensions other than listed are special and subject to special prices.

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
S-10	2	3-16	1-2	\$2.35	\$2.80
S-11	2	1-4	1-2	2.60	3.00
S-12	2	3-8	1-2	2.80	3.25

List continued on next page

For List of Keyways, see page 230.

Side Milling Cutters (Continued)

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
S-13	2	3-16	5-8	\$2.35	\$2.80
S-14	2	1-4	5-8	2.60	3.00
S-15	2	3-8	5-8	2.80	3.25
S-16	2 1-2	1-4	7-8	2.80	3.30
S-17	2 1-2	5-16	7-8	2.90	3.60
S-18	2 1-2	3-8	7-8	3.15	3.70
S-19	2 1-2	7-16	7-8	3.25	3.85
S-20	2 1-2	1-2	7-8	3.40	4.10
S-21	2 3-4	1-4	7-8	2.90	3.55
S-22	2 3-4	5-16	7-8	3.20	3.80
S-23	2 3-4	3-8	7-8	3.40	4.00
S-24	2 3-4	7-16	7-8	3.50	4.35
S-24A	2 3-4	7-16	1	3.50	4.35
S-25	2 3-4	1-2	7-8	3.60	4.45
S-25A	2 3-4	1-2	1	3.60	4.45
S-26	3	1-4	1	3.15	3.85
S-27	3	5-16	1	3.50	4.35
S-28	3	3-8	1	3.85	4.75
S-29	3	7-16	1	4.10	5.10
S-30	3	1-2	1	4.30	5.40
S-30A	3	1-2	1 1-4	4.30	5.40
S-31	3 1-2	7-16	1	4.80	5.75
S-32	3 1-2	1-2	1	5.35	6.95
S-33	3 1-2	9-16	1	5.55	7.65
S-34	3 1-2	5-8	1	5.80	7.65
S-34A	4	1-4	1	3.70	5.05
S-34B	4	3-8	1	5.15	6.85
S-34C	4	3-8	1 1-4	5.15	6.85
S-35	4	1-2	1	6.50	8.55
S-35A	4	1-2	1 1-4	6.50	8.55
S-36	4	5-8	1	7.10	9.45
S-38	4	5-8	1 1-4	7.10	9.45
S-39	4	3-4	1	7.65	10.40
S-39A	4	3-4	1 1-4	7.65	10.40
S-40	4	7-8	1	8.25	11.35
S-40A	4	7-8	1 1-4	8.25	11.35
S-40B	5	1-2	1	6.70	9.80
S-40C	5	1-2	1 1-4	6.70	9.80
S-41	5	3-4	1	8.10	12.45
S-42	5	3-4	1 1-4	8.10	12.45
S-42A	5	5-8	1	7.30	11.00
S-42B	5	5-8	1 1-4	7.30	11.00
S-43	5	7-8	1	8.75	13.65
S-43A	5	7-8	1 1-4	8.75	13.65
S-44	5	1	1	9.90	15.05
S-44A	5	1	1 1-4	9.90	15.05
S-44B	6	1-2	1	8.55	12.25
S-44C	6	1-2	1 1-4	8.55	12.25
S-44D	6	5-8	1 1-4	9.10	13.80
S-45	6	3-4	1	9.65	15.35
S-45A	6	3-4	1 1-4	9.65	15.35
S-46	6	7-8	1 1-4	10.25	16.90
S-47	6	1	1 1-2	11.00	18.55
S-47A	6	1	1	11.00	18.55
S-47B	6	1	1 1-4	11.00	18.55
S-47C	7	3-4	1 1-4	17.50	23.85
S-48	7	1	1 1-4	20.40	28.95
S-50	8	1	1 1-4	24.75	37.30

Coarse-Tooth Side Milling Cutters

HIGH-SPEED STEEL



See page 204 for explanation of advantages of Coarse-Tooth Cutters.

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	Price
S-300	2 1-2	1-4	1	\$3.30
S-301	2 1-2	5-16	1	3.60
S-302	2 1-2	3-8	1	3.70
S-304	3	1-4	1 1-4	3.85
S-305	3	5-16	1 1-4	4.35
S-306	3	3-8	1 1-4	4.75
S-307	3	7-16	1 1-4	5.10
S-308	3	1-2	1 1-4	5.40
S-312	3 1-2	7-16	1 1-4	5.75
S-313	3 1-2	1-2	1 1-4	6.95
S-314	3 1-2	5-8	1 1-4	7.65
S-317A	4	1-2	1 1-4	8.55
S-317	4	1-2	1 1-2	8.55
S-318A	4	5-8	1 1-4	9.45
S-318	4	5-8	1 1-2	9.45
S-319A	4	3-4	1 1-4	10.40
S-319	4	3-4	1 1-2	10.40
S-320A	4	7-8	1 1-4	11.35
S-320	4	7-8	1 1-2	11.35
S-323A	5	3-4	1 1-4	12.45
S-323	5	3-4	1 1-2	12.45
S-324A	5	7-8	1 1-4	13.65
S-324	5	7-8	1 1-2	13.65
S-325	5	1	1 1-2	15.05
S-326	6	3-4	1 1-2	15.35
S-328	6	1	1 1-2	18.55
S-329	8	1	1 1-2	37.30

Other sizes made to order. Prices on application.

For List of Keyways, see page 230.

Milling Cutters and Side Milling Cutters

WITH INSERTED TEETH



Side Milling Cutter

We recommend that Milling Cutters and Side Milling Cutters more than 8" in diameter be made with inserted teeth. With the exception of the Side Milling Cutters listed below, these cutters are made to order.

The teeth of the cutters are inserted in the periphery of the machinery steel body; regularly furnished with teeth of High-Speed Steel. Prices of cutters with carbon steel blades on application. The bushings, screws and teeth are interchangeable, thus allowing the teeth to be easily adjusted or removed.

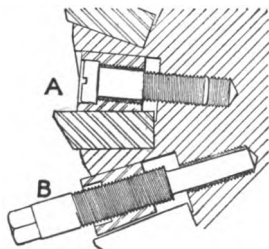


Milling Cutter

Side Milling Cutters

No.	Diameter, Inches	Width of Face, Inches	Hole, Inches	With High-Speed Steel Blades Price each
S-100	6	2	1 1/4	\$31.00
S-101	7	2	1 1/4	35.35
S-101A	7	2	1 3/4	35.35
S-102	8	2	1 1/2	40.00
S-102A	8	2	2	40.00
S-103	9	2	1 1/2	45.00
S-104	10	2	1 1/2	50.35

Other sizes made to order. Prices on application. List of Keyways, page 230.



Removing and Inserting Teeth

To remove a tooth, take out the screw A and insert extractor B as shown. By turning the extractor with a wrench the bushing is forced out. The tooth can then be removed.

To insert a tooth, place blade in position, drive bushing securely into place, using set C. Then insert screw A and tighten firmly. An extractor and set are furnished with each cutter.

Face Milling Cutters

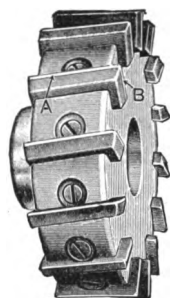
WITH INSERTED TEETH

**For Use on Brown & Sharpe Milling Machines
Having Threaded-Nose Spindle**

The cut shows a form of cutter especially adapted to all classes of face milling.

The body is of machinery steel provided with a taper hole and keyway and is held firmly in place on the arbor by a screw.

Cutters are regularly furnished with teeth of high-speed steel. Prices of cutters with carbon-steel teeth on application. The teeth are held in place by taper bushings and screws and can thus be easily adjusted or removed. The bushings, screws and teeth are interchangeable.



Left-Hand Cutter

In ordering, state whether Right- or Left-Hand Cutters are wanted

No. of Cutter	Size, Inches	Face A, Inches	Face B, Inches	No. of Taper Hole	No. of Arbor on which Cutter can be used	With High-Speed Steel Blades Price each
1	5 1-2	2 1-4	1 1-16	10	79 or 80	\$34.20
2	5 1-2	2 1-4	1 1-16	12	81, 82, 84, 85 or 87	35.20
3	6 1-2	2 1-4	1 1-16	10	79 or 80	38.60
4	6 1-2	2 1-4	1 1-16	12	81, 82, 83, 84, 85 or 87	39.60
6	7 1-2	2 1-4	1 1-16	12	81, 82, 83, 84, 85 or 87	44.70
7	8 1-2	2 1-4	1 3-16	12	81, 82, 83, 84, 85 or 87	49.90
8	9 1-2	2 1-4	1 3-16	12	81, 82, 83, 84, 85 or 87	55.70

Other sizes made to order.

In ordering teeth, state whether for Right- or Left-Hand Cutters.

List of Arbors for use with the above cutters shown on page 299.

Face Milling Cutters

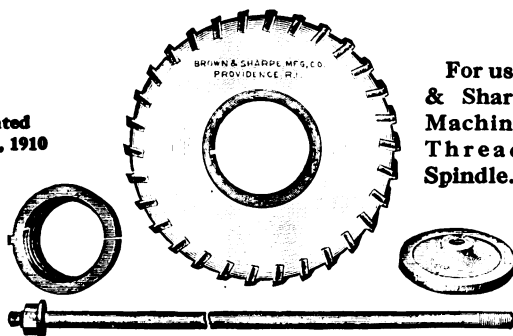
WITH INSERTED TEETH AND THREADED HOLES

Differ from above cutters in that they are provided with threaded holes and can be used directly upon the spindle of the machine, provided spindle has threaded nose.

No. of Cutter	Cutter			Hole		With High-Speed Steel Blades, Price each
	Diameter, Inches	Face A, Inches	Face B, Inches	Diameter, Inches	Thread	
10	5 1-2	2 1-4	1 1-16	2 1-2	4, L. H.	\$38.20
12	6 1-2	2 1-4	1 1-16	2 1-2	4, L. H.	43.10
16	7 1-2	2 1-4	1 1-16	2 1-2	4, L. H.	48.20
15	6 1-2	2 1-4	1 1-16	3 1-4	3 1-2, L. H.	43.10
18	7 1-2	2 1-4	1 1-16	3 1-4	3 1-2, L. H.	48.20
21	8 1-2	2 1-4	1 3-16	3 1-4	3 1-2, L. H.	53.40
24	9 1-2	2 1-4	1 3-16	3 1-4	3 1-2, L. H.	59.20
19	7 1-2	2 1-4	1 1-16	4	3, L. H.	48.20
22	8 1-2	2 1-4	1 3-16	4	3, L. H.	53.40
25	9 1-2	2 1-4	1 3-16	4	3, L. H.	59.20
22A	8 1-2	2 1-4	1 3-16	4 1-2	2 3-4, L. H.	53.40
26	9 1-2	2 1-4	1 3-16	4 1-2	2 3-4, L. H.	59.20

B & S Inserted-Tooth Face Milling Cutters

Patented
July 12, 1910



For use on Brown
& Sharpe Milling
Machines having
Threaded-Nose
Spindle.

This Face Milling Cutter embodies important features in the design of cutters of this type. Means are provided for quickly releasing the cutters from the spindle, and provision is made whereby the same cutter may be used on machines of different sizes of spindles by employing special sleeves.

The cutter is made with a taper hole to fit a split sleeve of steel that is screwed onto the spindle. It is keyed to the sleeve and is drawn onto the taper of the sleeve by a drawing-in bolt. As the drawing-in bolt is tightened the sleeve is contracted and closely grips the spindle, thus furnishing the full efficiency of the drive to the cutter at all times. It will be noted in the section on next page that the cutter is held close to the spindle shoulder, thus increasing the working space.

The body of the cutter is of machinery steel, while the blades are of high-speed steel.

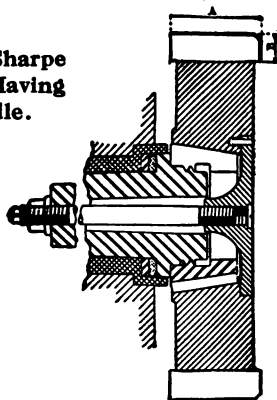
Cutters

No. of Cutter	Diam. of Cutter, Inches	Face A, Inches	Face B, Inches	Sm. Diam. of Taper Hole, Inches	Used with Sleeve No.	* Price
50	7	3	15-16	3	1	\$49.30
51	8	3	15-16	3	1	54.80
52	8	3 1-4	15-16	3 3-4	2 and 5	55.90
53	9	3 1-4	15-16	3 3-4	2 and 5	61.80
54	9	3 1-2	15-16	4 1-2	6 and 8	63.30
55	9	3 3-4	15-16	5	7, 9 and 10	64.70
56	10	3 1-4	15-16	3 3-4	2 and 5	68.40
57	10	3 1-2	15-16	4 1-2	6 and 8	69.90
58	10	3 3-4	15-16	5	7, 9 and 10	71.30
59	12	3 1-2	15-16	4 1-2	6 and 8	83.40
60	12	3 3-4	15-16	5	7, 9 and 10	85.30
61	15	3 3-4	15-16	5	7, 9 and 10	109.10

* For prices of Sleeves, Clamping Plates, and Drawing-in Bolts, see next page.

B & S Inserted-Tooth Face Milling Cutters (Continued)

For Use on Brown & Sharpe Milling Machines Having Threaded-Nose Spindle.



Sleeves

No. of Sleeve	Outside Diameter of Small End, Inches	Length, Inches	Taper per Foot in Diameter, Inches	Bore		Price
				Diameter, Inches	Threads per Inch	
1	3	2	3 1-2	2 1-2	4, L. H., U. S. S.	\$6.00
2	3 3-4	2 1-4	3 1-2	2 1-2	4, L. H., U. S. S.	6.50
5	3 3-4	2 1-4	3 1-2	3 1-4	3 1-2, L. H., U. S. S.	7.00
6	4 1-2	2 1-2	3 1-2	3 1-4	3 1-2, L. H., U. S. S.	7.50
7	5	2 3-4	3 1-2	3 1-4	3 1-2, L. H., U. S. S.	8.00
8	4 1-2	2 1-2	3 1-2	4	3, L. H., U. S. S.	8.00
9	5	2 3-4	3 1-2	4	3, L. H., U. S. S.	8.50
10	5	2 3-4	3 1-2	4 1-2	2 3-4, L. H., U. S. S.	9.00

Clamping Plates

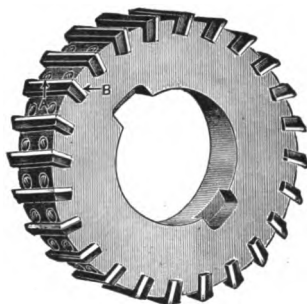
No. of Plate	Used with Cutter	Diameter of Tapped Hole, Inches	Price
1	50 and 51	5-8	\$1.00
2	52, 53 and 56	5-8	1.00
3	52, 53 and 56	11-16	1.00
4	54, 57 and 59	11-16	1.00
5	55, 58, 60 and 61	11-16	1.00

Drawing-In Bolts and Nuts. Price, \$1.50

The drawing-in bolts with nuts for use with these cutters are furnished on short notice. When ordering, the diameter of the spindle hole and the length of the spindle over all must be given.

Inserted-Tooth Face Milling Cutters

For Use on Brown & Sharpe Milling Machines Having Taper-Nose Spindle.



These cutters are fitted directly on nose of spindle without the use of an arbor. The body of the cutter is of machinery steel; the blades are of high-speed steel.

In ordering, state whether Right- or Left-Hand Cutters are wanted.

No. of Cutter	Diam. of Cutter, Inches	Face A, Inches	Face B, Inches	Machines where used	Price with High-Speed Steel Blades and Machinery Steel Body
150	6	2 1-4	7-8	*1-*1A-2-2A Univ. M. M.; 1 Hy. Vert. Sp. M. Att. *1-*1B-2-2B Pl. M. M.; 21 Auto M. M.	\$41.90
151	7	3	15-16		49.30
152	8	3	15-16		54.80
155	8 1-2	3 1-4	15-16	{ 3-3A-3A Hy.-4A-4A Hy. Univ. M. M.; 2-3-5 Vert. Sp. M. M.; 2B Hy.-3-3B-3B Hy.-4B-4B Hy.-5B Hy.-13B Pl. M. M.; 2 Hy.-3-4-5-3 Hy.-4 Hy.-5 Hy. Vert. Sp. M. Att. }	60.00
156	9 1-2	3 5-8	15-16		68.00
157	10 1-2	3 5-8	15-16		74.60
158	12	3 5-8	15-16		85.30
159	15	3 5-8	15-16		109.10

* With or without Back Gears.

Inserted-Tooth Face Milling Cutters

Used in connection with Arbors for Face Milling Cutters Nos. 580, 581, 582, 583, on page 288.

In ordering, state whether Right- or Left-Hand Cutters are wanted.

No. of Cutter	Diam. of Cutter, Inches	Face A, Inches	Face B, Inches	Machines where used	Price with High-Speed Steel Blades and Machinery Steel Body
101	5 1-2	2 1-4	1 1-16	On all machines with Taper-Nose Spindle Used in conjunction with Arbors for Face Milling Cutters on page 288	\$35.70
103	6 1-2	2 1-4	1 1-16		40.10
106	7 1-2	2 1-4	1 1-16		45.20

See pages 292-294 for explanation of Taper-Nose Spindle.

End Mills



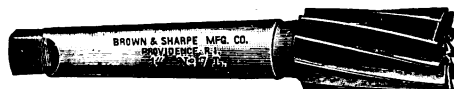
Left-Hand Mill

In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
E-10	1-4	4	13-16	2 7-16	\$1.25	\$1.40
E-11	1-4	5	13-16	3	1.45	1.70
E-12	5-16	4	7-8	2 1-2	1.25	1.40
E-13	5-16	5	7-8	3 1-16	1.45	1.70
E-14	3-8	4	7-8	2 1-2	1.40	1.55
E-15	3-8	5	7-8	3 1-16	1.55	1.75
E-16	7-16	4	15-16	2 9-16	1.40	1.55
E-17	7-16	5	15-16	3 1-8	1.60	1.80
E-18	1-2	5	1	3 3-16	1.65	1.90
E-19	1-2	7	1 1-8	5 1-8	1.80	2.40
E-20	9-16	5	1 1-16	3 1-4	1.70	2.00
E-21	9-16	7	1 1-4	5 1-4	2.00	2.50
E-22	5-8	5	1 1-4	3 7-16	1.80	2.20
E-23	5-8	7	1 1-2	5 1-2	2.15	2.80
E-24	11-16	7	1 1-2	5 1-2	2.20	2.85
E-26	3-4	7	1 5-8	5 5-8	2.25	2.95
E-27	3-4	9	1 5-8	6 7-8	2.50	3.85
E-30	7-8	7	1 3-4	5 3-4	2.65	3.55
E-31	7-8	9	1 3-4	7	2.85	4.25
E-34	1	7	1 7-8	5 7-8	2.70	3.80
E-35	1	9	1 7-8	7 1-8	2.90	4.35
E-38	1 1-8	7	2	6	2.85	4.20
E-39	1 1-8	9	2	7 1-4	3.00	4.60
E-42	1 1-4	7	2	6	2.85	4.45
E-43	1 1-4	9	2	7 1-4	3.25	5.10
E-45	1 3-8	9	2 1-8	7 3-8	3.45	6.25
E-47	1 1-2	9	2 1-4	7 1-2	3.80	6.85

For list of Collets, see pages 289 and 300. For list of Tapers, see page 290.
Morse Taper End Mills listed on page 223.

Spiral End Mills



Left-Hand Mill

In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
E-100	1-4	4	13-16	2 7-16	\$1.25	\$1.40
E-101	1-4	5	13-16	3	1.45	1.70
E-102	5-16	4	7-8	2 1-2	1.25	1.40
E-103	5-16	5	7-8	3 1-16	1.45	1.70
E-104	3-8	4	7-8	2 1-2	1.40	1.55
E-105	3-8	5	7-8	3 1-16	1.55	1.75
E-106	7-16	4	15-16	2 9-16	1.40	1.55
E-107	7-16	5	15-16	3 1-8	1.60	1.80
E-108	1-2	5	1	3 3-16	1.65	1.90
E-109	1-2	7	1 1-8	5 1-8	1.80	2.40
E-110	9-16	5	1 1-16	3 1-4	1.70	2.00
E-111	9-16	7	1 1-4	5 1-4	2.00	2.50
E-112	5-8	5	1 1-4	3 7-16	1.80	2.20
E-113	5-8	7	1 1-2	5 1-2	2.15	2.80
E-114	11-16	7	1 1-2	5 1-2	2.20	2.85
E-115	11-16	9	1 1-2	6 3-4	2.40	3.75
E-116	3-4	7	1 5-8	5 5-8	2.25	2.95
E-117	3-4	9	1 5-8	6 7-8	2.50	3.85
E-120	7-8	7	1 3-4	5 3-4	2.65	3.55
E-121	7-8	9	1 3-4	7	2.85	4.25
E-124	1	7	1 7-8	5 7-8	2.70	3.80
E-125	1	9	1 7-8	7 1-8	2.90	4.35
E-128	1 1-8	7	2	6	2.85	4.20
E-129	1 1-8	9	2	7 1-4	3.00	4.60
E-132	1 1-4	7	2	6	2.85	4.45
E-133	1 1-4	9	2	7 1-4	3.25	5.10
E-135	1 3-8	9	2 1-8	7 3-8	3.45	6.25
E-137	1 1-2	9	2 1-4	7 1-2	3.80	6.85
E-138	1 5-8	9	2 3-8	7 5-8	4.15	7.45
E-139	1 3-4	9	2 1-2	7 3-4	4.45	8.30

For list of Collets, see pages 289 and 300. For list of Tapers, see page 290.
Morse Taper Spiral End Mills listed on page 223.

End Mills—Morse Taper



End Mills and Spiral End Mills listed herewith are furnished regularly in right hand only.
Left-hand cutters can be furnished. Prices on application.

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
E-300	1-4	1	13-16	3 5-8	\$1.45	\$1.70
E-301	5-16	1	7-8	3 11-16	1.45	1.70
E-302	3-8	1	7-8	3 11-16	1.55	1.75
E-303	7-16	1	15-16	3 3-4	1.60	1.85
E-304	7-16	2	1	4 1-2	1.75	2.25
E-305	1-2	1	1	3 13-16	1.65	1.90
E-306	1-2	2	1 1-8	4 5-8	1.80	2.30
E-307	9-16	1	1 1-16	3 7-8	1.70	2.00
E-308	9-16	2	1 1-4	4 3-4	2.00	2.40
E-309	5-8	2	1 1-2	5	2.00	2.50
E-310	11-16	2	1 1-2	5	2.20	2.75
E-311	3-4	2	1 5-8	5 1-8	2.25	2.85
E-312	3-4	3	1 5-8	5 15-16	2.50	3.45
E-315	7-8	2	1 3-4	5 1-4	2.65	3.40
E-316	7-8	3	1 3-4	6 1-16	2.85	3.75
E-319	1	2	1 7-8	5 3-8	2.70	3.60
E-320	1	3	1 7-8	6 3-16	2.90	4.00
E-323	1 1-8	3	2	6 5-16	3.00	4.25
E-325	1 1-4	3	2	6 5-16	3.10	4.65

Spiral End Mills—Morse Taper

See note above



No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
E-395	1-4	1	13-16	3 5-8	\$1.45	\$1.70
E-396	5-16	1	7-8	3 11-16	1.45	1.70
E-397	3-8	1	7-8	3 11-16	1.55	1.75
E-398	7-16	1	15-16	3 3-4	1.60	1.85
E-399	7-16	2	1	4 1-2	1.75	2.25
E-400	1-2	1	1	3 13-16	1.65	1.90
E-401	1-2	2	1 1-8	4 5-8	1.80	2.30
E-402	9-16	1	1 1-16	3 7-8	1.70	2.00
E-403	9-16	2	1 1-4	4 3-4	2.00	2.40
E-404	5-8	2	1 1-2	5	2.00	2.50
E-405	11-16	2	1 1-2	5	2.20	2.75
E-406	3-4	2	1 5-8	5 1-8	2.25	2.85
E-407	3-4	3	1 5-8	5 15-16	2.50	3.45
E-410	7-8	2	1 3-4	5 1-4	2.65	3.40
E-411	7-8	3	1 3-4	6 1-16	2.85	3.75
E-414	1	2	1 7-8	5 3-8	2.70	3.60
E-415	1	3	1 7-8	6 3-16	2.90	4.00
E-418	1 1-8	3	2	6 5-16	3.00	4.25
E-420	1 1-4	3	2	6 5-16	3.10	4.65
E-421	1 1-4	4	2	7 3-8	3.25	5.00
E-424	1 3-8	3	2 1-8	6 7-16	3.35	5.20
E-425	1 3-8	4	2 1-8	7 1-2	3.45	5.60
E-428	1 1-2	3	2 1-4	6 9-16	3.45	5.65
E-429	1 1-2	4	2 1-4	7 5-8	3.80	6.25

Coarse-Tooth Spiral End Mills

HIGH-SPEED STEEL



See page 204 for explanation of advantages of Coarse-Tooth Cutters
In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	No. of Taper	Length of Cut, Inches	Whole Length, Inches	High-Speed Steel Cutters Price each
E-700	1-4	4	13-16	2 7-16	\$1.40
E-701	1-4	5	13-16	3	1.70
E-702	5-16	4	7-8	2 1-2	1.40
E-703	5-16	5	7-8	3 1-16	1.70
E-704	3-8	4	7-8	2 1-2	1.55
E-705	3-8	5	7-8	3 1-16	1.75
E-706	7-16	4	15-16	2 9-16	1.55
E-707	7-16	5	15-16	3 1-8	1.80
E-708	1-2	5	1	3 3-16	1.90
E-709	1-2	7	1 1-8	5 1-8	2.40
E-711	9-16	7	1 1-4	5 1-4	2.50
E-712	5-8	5	1 1-4	3 7-16	2.20
E-713	5-8	7	1 1-2	5 1-2	2.80
E-714	11-16	7	1 1-2	5 1-2	2.85
E-716	3-4	7	1 5-8	5 5-8	2.95
E-717	3-4	9	1 5-8	6 7-8	3.85
E-720	7-8	7	1 3-4	5 3-4	3.55
E-721	7-8	9	1 3-4	7	4.25
E-724	1	7	1 7-8	5 7-8	3.80
E-725	1	9	1 7-8	7 1-8	4.35
E-728	1 1-8	7	2	6	4.20
E-729	1 1-8	9	2	7 1-4	4.60
E-731	1 3-16	9	2	7 1-4	4.90
E-732	1 1-4	7	2	6	4.45
E-733	1 1-4	9	2	7 1-4	5.10
*E-733A	1 1-4	10	2 1-4	9 1-2	5.80
E-735	1 3-8	9	2 1-8	7 3-8	6.25
*E-735A	1 3-8	10	2 1-4	9 1-2	6.75
E-737	1 1-2	9	2 1-4	7 1-2	6.85
*E-737A	1 1-2	10	2 1-2	9 3-4	7.80
E-738	1 5-8	9	2 3-8	7 5-8	7.45
*E-738A	1 5-8	10	2 1-2	9 3-4	8.50
E-739	1 3-4	9	2 1-2	7 3-4	8.30
*E-739A	1 3-4	10	2 3-4	10	9.25
*E-740	2	10	2 3-4	10	10.50

For List of Collets, see pages 289 and 300. For List of Tapers, see page 290.

* Made to order.

Straight-Shank End Mills

FOR USE WITH SPRING COLLETS



In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	Length of Cut, Inches	Whole Length, Inches	Carbon Steel Cutters Price each	High-Speed Cutters Price each
E-650	1-8	5-16	1 1-4	\$0.45	\$0.50
E-651	5-32	5-16	1 1-4	.50	.60
E-652	3-16	9-16	1 1-2	.55	.70
E-653	7-32	9-16	1 1-2	.65	.80
E-654	1-4	3-4	1 7-8	.70	.90
E-655	9-32	3-4	1 7-8	.75	1.00
E-656	5-16	13-16	1 15-16	.90	1.10
E-658	3-8	13-16	2	1.00	1.30
E-660	7-16	7-8	2 1-8	1.25	1.50
E-661	1-2	15-16	2 1-4	1.60	1.70
E-662	9-16	15-16	2 5-16	1.70	1.90
E-663	5-8	1	2 3-8	1.90	2.10
E-665	3-4	1 1-8	2 15-16	2.15	2.50

Diameter of shank is same as diameter of cut taken.

All Mills less than 3-8" diameter have straight teeth.

All Mills 3-8" and over have spiral teeth.

Slotting End Mills—"Two Lipped"

HIGH-SPEED STEEL



In ordering, state whether Right- or Left-Hand Mills are wanted

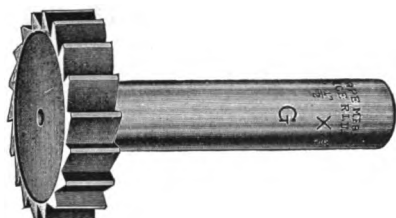
These End Mills are found especially adaptable to rapidly milling slots in steel and iron from the solid, where previously it was necessary to drill a series of holes and make several cuts in milling the slot. The best results are obtained by maintaining a high surface speed.

A depth of cut equal to one-half the diameter of the mill can usually be taken from solid stock.

No.	Diameter, Inches	No. of Taper Shank	Length of Cut, Inches	Whole Length, Inches	Price
E-597	1-4	4	3-8	2	\$1.40
E-598	1-4	5	3-8	2 1-2	1.70
E-599	5-16	5	15-32	2 19-32	1.70
E-600	1-4	7	3-8	4 3-8	2.00
E-601	5-16	7	15-32	4 15-32	2.10
E-602	3-8	7	9-16	4 9-16	2.15
E-603	7-16	7	21-32	4 21-32	2.25
E-604	1-2	7	3-4	4 3-4	2.40
E-605	9-16	7	27-32	4 27-32	2.50
E-606	5-8	7	15-16	4 15-16	2.80
E-607	11-16	7	1 1-32	5 1-32	2.85
E-608	3-4	7	1 1-8	5 1-8	2.95
E-610	13-16	7	1 7-32	5 7-32	3.35
E-612	7-8	7	1 5-16	5 5-16	3.55
E-613	7-8	9	1 5-16	6 9-16	4.25
E-614	15-16	9	1 13-32	6 21-32	4.25
E-615	1	9	1 1-2	6 3-4	4.35
E-617	1 1-8	9	1 11-16	6 15-16	4.60
E-619	1 1-4	9	1 7-8	7 1-8	5.10
E-621	1 3-8	9	2 1-16	7 5-16	6.25
E-623	1 1-2	9	2 1-4	7 1-2	6.85

Collets, pages 289 and 300. For list of Tapers, see page 290.

Woodruff Key Seat Cutters



Right-Hand Cutters only are carried in stock. Prices of Left-Hand Cutters on application

No.	Diameter, Inches	Thickness, Inches	Shank, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
*1	1-2	1-16	1-2	\$1.20	...
*2	1-2	3-32	1-2	1.20	...
3	1-2	1-8	1-2	1.20	\$1.20
4	5-8	3-32	1-2	1.40	1.40
5	5-8	1-8	1-2	1.40	1.40
6	5-8	5-32	1-2	1.40	1.40
7	3-4	1-8	1-2	1.55	1.60
8	3-4	5-32	1-2	1.55	1.60
9	3-4	3-16	1-2	1.55	1.60
10	7-8	5-32	1-2	1.75	1.95
11	7-8	3-16	1-2	1.75	1.95
12	7-8	7-32	1-2	1.75	1.95
A	7-8	1-4	1-2	1.75	1.95
13	1	3-16	1-2	2.00	2.35
14	1	7-32	1-2	2.00	2.35
15	1	1-4	1-2	2.00	2.35
B	1	5-16	1-2	2.00	2.35
16	1 1-8	3-16	1-2	2.20	2.75
17	1 1-8	7-32	1-2	2.20	2.75
18	1 1-8	1-4	1-2	2.20	2.75
C	1 1-8	5-16	1-2	2.20	2.75
19	1 1-4	3-16	1-2	2.40	3.20
20	1 1-4	7-32	1-2	2.40	3.20
21	1 1-4	1-4	1-2	2.40	3.20
D	1 1-4	5-16	1-2	2.40	3.20
E	1 1-4	3-8	1-2	2.40	3.20
22	1 3-8	1-4	1-2	2.70	3.80
23	1 3-8	5-16	1-2	2.70	3.80
F	1 3-8	3-8	1-2	2.70	3.80
24	1 1-2	1-4	1-2	2.70	3.95
25	1 1-2	5-16	1-2	2.70	3.95
G	1 1-2	3-8	1-2	2.70	3.95

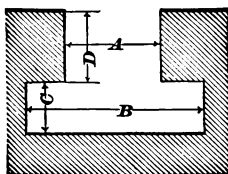
Cutters for Keyways Nos. 126-129 inc., 26-29 inc., Rx to Vx inc., R to V inc., and 30-36 inc., can be furnished of the side milling type. Prices on application.

* Not made from High-Speed Steel.

Standard T Slot Cutters



Left-Hand Cutter



In ordering, state whether Right- or Left-Hand Cutters are wanted

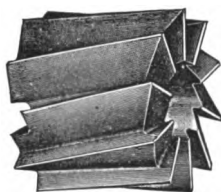
No. of Cutter	Width of Slot A, Inches	Diameter of Neck of Cutter, Inches	Width of Slot B, Inches	Depth C, Inches	Extreme Limit D, Inches	No. of Taper	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
4	1-4	7-32	1-2	5-32	5-16	4	\$2.00	\$2.10
7	1-4	7-32	1-2	5-32	5-16	5	2.10	2.25
10	5-16	9-32	5-8	5-32	3-8	5	2.20	2.60
13	5-16	9-32	5-8	5-32	3-8	7	2.65	3.25
16	3-8	11-32	11-16	7-32	7-16	5	2.55	2.90
19	3-8	11-32	11-16	7-32	7-16	7	2.80	3.35
22	7-16	3-8	13-16	7-32	7-16	7	3.00	3.65
28	1-2	7-16	15-16	9-32	9-16	7	3.30	4.15
31	1-2	7-16	15-16	9-32	9-16	9	3.50	4.80
34	5-8	17-32	1 3-16	13-32	3-4	9	3.90	5.55
37	3-4	21-32	1 5-16	17-32	1	9	4.35	6.35
40	7-8	25-32	1 5-8	11-16	1 1-16	9	4.75	7.75

These cutters are made 1-32" larger in diameter and 1-64" greater in thickness than the figures given, to allow for sharpening.

Other sizes made to order.

Collets, pages 289 and 300. For list of Tapers, see page 290.

Spiral Shell End Mills

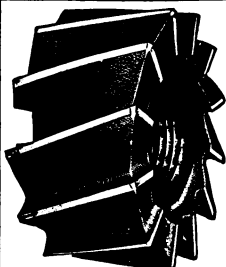


Left-Hand Mill

In ordering, state whether Right- or Left-Hand Mills are wanted

No.	Diameter, Inches	Length of Cut, Inches	No. of Arbor on which Cutter can be used	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
F-100	1 1-4	1 1-4	89	1-2	\$3.90	\$4.50
F-101	1 5-16	1 1-4		1-2	4.00	4.55
F-102	1 3-8	1 1-4		1-2	4.00	4.60
F-103	1 7-16	1 1-4		1-2	4.10	4.70
F-104	1 1-2	1 1-4		1-2	4.10	4.80
F-105	1 9-16	1 3-4	90	3-4	5.00	6.00
F-106	1 5-8	1 3-4		3-4	5.00	6.15
F-107	1 11-16	1 3-4		3-4	5.15	6.30
F-108	1 3-4	1 3-4		3-4	5.15	6.45
F-109	1 13-16	1 3-4		3-4	5.30	6.60
F-110	1 7-8	1 3-4	99	3-4	5.30	6.70
F-111	1 15-16	1 3-4		3-4	5.45	6.85
F-112	2	1 3-4		3-4	5.45	7.05
F-114	2 1-8	1 3-4		3-4	5.60	7.25
F-116	2 1-4	2 1-4		3-4	5.60	7.25
F-118	2 3-8	2 1-4	91	1	6.20	8.55
F-120	2 1-2	2 1-4		1	6.35	8.85
F-122	2 5-8	2 1-4		1	6.50	9.15
F-124	2 3-4	2 1-4		1	6.80	9.75
F-126	2 7-8	2 1-4		1	7.15	10.40
F-128	3	2 1-4	102	1	7.55	11.00
				1	7.55	11.00
			104	1	7.55	11.00
				1	7.55	11.00
			105	1	8.00	11.75
				1	8.00	11.75

List of Arbors for use with the above End Mills, page 287.



Coarse-Tooth Spiral Shell End Mills

HIGH-SPEED STEEL

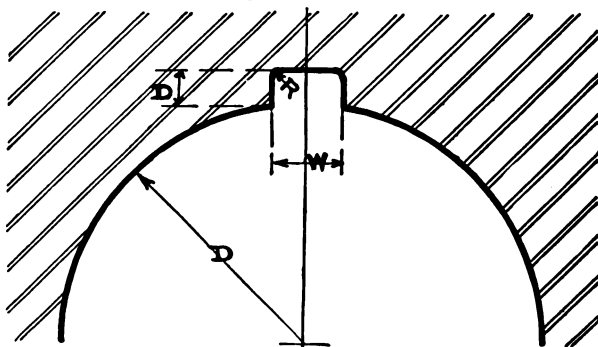
In ordering, state whether Right- or Left-Hand Mills are wanted.

See page 204 for explanation of advantages of Coarse-Tooth Cutters.

No.	Diameter, Inches	Length of Cut, Inches	Hole, Inches	Hole Tapped, Threads per Inch	Price
F-200	2 1-2	1 1-4	1	10	\$6.60
F-201	3	1 3-4	1 1-4	8	10.40
F-202	3 1-2	2	1 1-2	8	14.80
F-203	4	2	1 1-2	8	17.75
F-204	5	2	1 1-2	8	25.75
F-205	6	2	1 1-2	8	36.20

For List of Arbors, see pages 286 and 297.

Standard Keyways for Cutters



Diameter (D) of Hole	Width (W) of Keyway, In.	Depth (D) of Keyway, In.	Radius (R), Inches
3-8" to 9-16"	3-32	3-64	.020
5-8 to 7-8 or 16 m/m to 21 m/m	1-8	1-16	.030
15-16 to 1 1-8 or 22 " to 26 "	5-32	5-64	.035
1 3-16 to 1 3-8 or 27 " to 31 "	3-16	3-32	.040
1 7-16 to 1 3-4* or 32 " to 37 "	1-4	1-8	.050
1 13-16 to 2* or 38 " to 44 "	5-16	5-32	.060
2 1-16 to 2 1-2 or 45 "	3-8	3-16	.060
2 9-16 to 3	7-16	3-16	.060

* 1 1-2", 1 3-4" and 2". For all Gear Cutters of these diameters, use 5-16", 3-8" and 1-2" keys, respectively. Gear Cutters with 1 1-2" hole can also be furnished with 3-8" keyway.



Angular Cutters

These Angular Cutters of 45°, 50°, 60°, 70° or 80° angle, both right- and left-hand, are suitable for cutting the teeth of cutters and mills.

In ordering, state whether Right- or Left-Hand Cutters are wanted.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
J-10	2 1-2	1-2	7-8	\$3.40	\$4.10
J-11	2 3-4	1-2	1	3.60	4.45
J-12	3	1-2	1 1-4	4.30	5.40

For List of Keyways, see page 230.

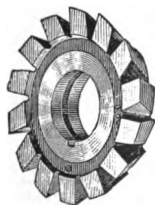
Angular Cutters with Threaded Holes

These cutters have an angle of 60° and are made both right- and left-hand.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Thread	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
J-25	1 1-4	7-16	3-8	20, L	\$3.00	\$3.60
J-26	1 5-8	9-16	1-2	16, L	3.70	4.50
*J-27	4	1 1-4	1 1-4	8, L	10.50	15.00

* Left hand only.

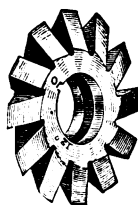
Angular Cutters and Cutters for Spiral Mills



Right-Hand Angular
Cutter

Made to Order

These cutters can be sharpened by grinding without changing their form.



Cutter for Spiral
Mills

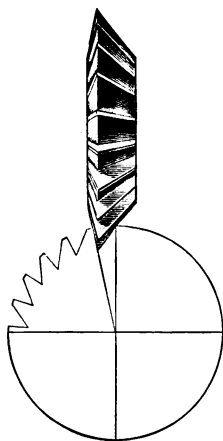


Double Angle Cutters

These Cutters are carried in stock with 45°, 60° or 90° included angle.

V-shaped cutters of any angle made to order.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
J-100	2 1-2	1-2	7-8	\$3.40	\$4.10
J-101	2 3-4	1-2	1	3.60	4.45
J-102	3	1-2	1 1-4	4.30	5.40



Cutters for Spiral Mills

These Cutters are especially adapted to the cutting of spiral mills, and are made with either 40°, 48° or 53° angle on one side and 12° on the other.

The cut illustrates a right-hand cutter at work, in the position required in cutting the teeth of a spiral mill.

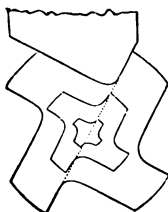
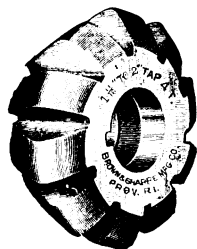
In ordering, state whether Right- or Left-Hand Cutters are wanted.

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
J-150	2 1-2	1-2	7-8	\$3.40	\$4.10
J-151	2 3-4	1-2	1	3.60	4.45
J-152	3	1-2	1 1-4	4.30	5.40
*J-153	3 1-4	1-2	1 1-2	4.80	6.15

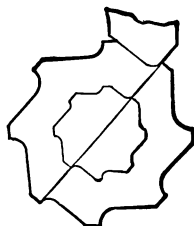
* Furnished 53° on one side and 12° on the other.

For List of Keyways, see page 230.

Cutters for Grooving Taps and Reamers



Form of Tap



Form of Reamer

Catalog No.	Cutter No.	Diameter of Tap, Inches	Number of Teeth in Tap	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-10	1	0 to 1-8	4	2	1	\$2.10	\$3.15
L-11	2	5-32 to 1-4	4	2	1	2.45	3.70
L-12	3	9-32 to 3-8	4	2 1-8	1	3.35	5.10
L-13	4	7-16 to 5-8	4	2 1-4	1	3.60	5.45
L-14	5	11-16 to 7-8	4	2 3-8	1	4.15	6.30
L-15	6	15-16 to 1 1-4	4	2 1-2	1	4.70	7.10
L-16	7	1 5-16 to 1 5-8	4	2 5-8	1	5.85	8.85
L-17	8	1 11-16 to 2	4	2 7-8	1	6.75	10.20

No. L-10 Cutter is suitable for grooving taps 1-8" or less diameter; No. L-11 for taps larger than 1-8" and up to 1-4" diameter, etc. See cut.

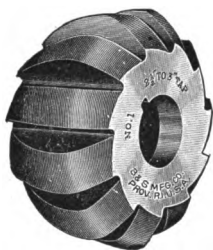
These cutters are also adapted for fluting reamers, for which purpose it is necessary only to cut one or more grooves of a less depth in order to flute unevenly. See cut.

Catalog No.	Cutter No.	Diameter of Reamer, Inches	Number of Teeth in Reamer	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-10	1	1-8 to 1-4	6	2	1	\$2.10	\$3.15
L-11	2	9-32 to 3-8	6	2	1	2.45	3.70
L-12	3	13-32 to 1-2	6	2 1-8	1	3.35	5.10
L-13	4	17-32 to 1 1-8	6 to 8	2 1-4	1	3.60	5.45
L-14	5	1 5-32 to 1 3-4	8 to 10	2 3-8	1	4.15	6.30
L-15	6	1 25-32 to 2	10	2 1-2	1	4.70	7.10
L-16	7	2 1-16 to 2 1-2	10	2 5-8	1	5.85	8.85
L-17	8	2 9-16 to 3	10	2 7-8	1	6.75	10.20

These cutters can be sharpened by grinding without changing their form.

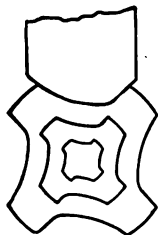
In ordering, give number of cutter, or diameter and number of teeth of tap or reamer as by above lists.

For List of Keyways, see page 230.



Cutters for Grooving Taps

Catalog No.	Cutter No.	Diameter of Tap, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-50	1	0 to 1-8	2	1	\$2.10	\$3.15
L-51	2	5-32 to 1-4	2	1	2.45	3.70
L-52	3	9-32 to 3-8	2 1-8	1	3.35	5.10
L-53	4	7-16 to 5-8	2 1-4	1	3.60	5.45
L-54	5	11-16 to 7-8	2 3-8	1	4.15	6.30
L-55	6	15-16 to 1 1-4	2 1-2	1	4.70	7.10
L-56	7	1 5-16 to 1 5-8	2 5-8	1	5.85	8.85
L-57	8	1 11-16 to 2	2 7-8	1	6.55	9.90
L-58	9	2 1-16 to 2 7-16	3 1-8	1	8.10	12.25
L-59	10	2 1-2 to 3	3 3-8	1	9.35	14.45



Form of Tap

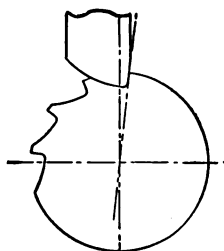
We make a style of cutter adapted to grooving taps only. These cutters do not make so deep a groove in proportion to the width as the tap and reamer cutters. They are not suitable for fluting reamers. See cut.

These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of tap, as by above list.

For List of Keyways, see page 230.

Cutters for Fluting Reamers

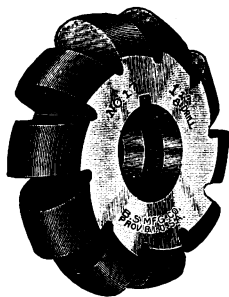


The cut shows a form of cutter that makes a tooth that allows the chips to be removed more readily and has greater strength than the form made by the cutters for grooving taps and reamers.

In ordering, give number of cutter or diameter of reamer by the following list.

Catalog No.	Cutter No.	Diameter of Reamer, Inches	Number of Teeth	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-75	1	1-8 to 3-16	6	1	\$2.45	\$3.70
L-76	2	1-4 to 5-16	6	1	3.10	4.75
L-77	3	3-8 to 7-16	6	1	3.35	5.00
L-78	4	1-2 to 11-16	6 to 8	1	3.60	5.45
L-79	5	3-4 to 1	8	1	3.80	5.70
L-80	6	1 1-16 to 1 1-2	10	1	3.90	5.85
L-81	7	1 9-16 to 2 1-8	12	1	4.30	6.65
L-82	8	2 1-4 to 3	14	1	4.80	7.30
L-83	9	3 1-16 to 3 1-2	14	1	5.90	9.00
L-84	10	3 9-16 to 5	14 to 16	1	7.00	10.50

For List of Keyways, see page 230.

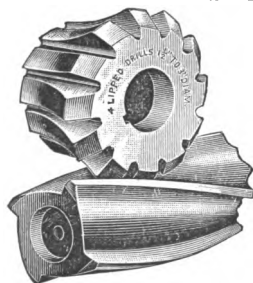


Cutters for Making Twist Drills

These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of drill by the following list.

Catalog No.	Cutter No.	Diameter of Drill, Inches	Diam. of Circle made by Cutter, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-100	1	1-16	.06	2	1	\$1.90	\$2.85
L-101	2	1-8	.08	2	1	2.10	3.15
L-102	3	3-16	.11	2	1	2.10	3.15
L-103	4	1-4	.15	2	1	2.45	3.70
L-104	5	5-16	.19	2 1-4	1	2.55	3.90
L-105	6	3-8	.23	2 1-4	1	3.30	5.00
L-106	7	7-16	.27	2 1-4	1	3.35	5.10
L-107	8	1-2	.31	2 1-4	1	3.35	5.10
L-108	9	9-16	.35	2 3-8	1	3.80	5.70
L-109	10	5-8	.39	2 3-8	1	3.90	5.90
L-110	11	11-16	.44	2 3-8	1	3.90	5.90
L-111	12	3-4	.50	2 1-2	1	4.00	6.10
L-112	13	13-16	.56	2 1-2	1	4.15	6.30
L-113	14	7-8	.62	2 3-4	1	4.65	7.00
L-114	15	15-16	.70	2 3-4	1	5.00	7.60
L-115	16	1	.77	3	1	5.70	8.65
L-116	17	1 1-8	.85	3	1	5.90	9.00



Cutters for Making Four-Lipped Twist Drills

These cutters are especially adapted to cutting Four-Lipped Twist Drills that are used in screw and chucking machines for roughing out holes previous to reaming, and can be sharpened by grinding without changing their form.

In ordering, give number of cutter or size of drill by the following list:

Catalog No.	Cutter No.	Diameter of Drill, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-250	1	to 1 1-2	2 3-4	1	\$6.15	\$9.40
L-251	2	1 1-2 to 3	3	1	8.85	13.45

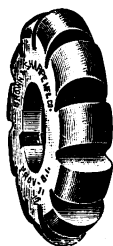
For List of Keyways, see page 230.

Cutters for Making Straight-Lipped Twist Drills



Catalog No.	Cutter No.	Diameter of Drill, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
L-200	1	1-16	2	1	\$1.90	\$2.85
L-201	2	1-8	2	1	2.10	3.15
L-202	3	3-16	2	1	2.45	3.70
L-203	4	1-4	2	1	2.45	3.70
L-204	5	5-16	2 1-4	1	3.30	5.00
L-205	6	3-8	2 1-4	1	3.35	5.10
L-206	7	7-16	2 1-4	1	3.45	5.25
L-207	8	1-2	2 1-4	1	3.45	5.25
L-208	9	9-16	2 5-8	1	4.15	6.25
L-209	10	5-8	2 5-8	1	4.35	6.55
L-210	11	11-16	2 5-8	1	4.50	6.75
L-211	12	3-4	2 5-8	1	4.50	6.75
L-212	13	13-16	2 7-8	1	5.00	7.65
L-213	14	7-8	2 7-8	1	5.25	8.00
L-214	15	15-16	2 7-8	1	5.50	8.35
L-215	16	1	3	1	5.50	8.35
L-216	17	1 1-8	3	1	5.90	9.00
L-217	18	1 1-4	3 1-4	1	6.70	10.10
L-218	19	1 1-2	3 3-4	1 1-4	8.60	13.00
L-219	20	1 3-4	3 3-4	1 1-4	9.00	13.65
L-220	21	2	4	1 1-4	10.25	15.55
L-221	22	2 1-4	4 1-4	1 1-4	12.70	17.40
L-222	23	2 1-2	4 1-2	1 1-4	12.85	19.45

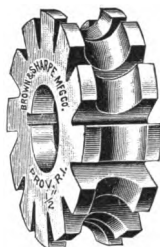
These cutters can be sharpened by grinding without changing their form.
In ordering, give number of cutter or diameter of drill by above list.
For List of Keyways, see page 230.

**Convex**

Convex and Concave Cutters

FOR MILLING HALF CIRCLES

These cutters can be sharpened by
grinding without changing
their outline

**Convex****Concave**

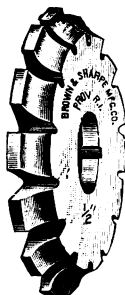
No.	Diameter of Circle, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
C-10	1-8	2	7-8	\$2.10	\$3.15
C-11	3-16	2	7-8	2.45	3.70
C-12	1-4	2	7-8	3.10	4.75
C-13	5-16	2 1-4	7-8	3.35	5.10
C-14	3-8	2 1-4	7-8	3.45	5.25
C-15	7-16	2 1-4	7-8	3.60	5.45
C-16	1-2	2 1-4	7-8	3.80	5.70
C-17	5-8	2 3-4	1	4.65	7.00
C-18	3-4	3	1	5.50	8.35
C-19	7-8	3 1-4	1	6.45	9.75
C-20	1	3 1-4	1	7.00	10.50
C-21	1 1-8	4	1 1-4	9.35	14.20
C-22	1 1-4	4	1 1-4	9.65	14.65
C-23	1 3-8	4 1-4	1 1-4	10.70	16.20
C-24	1 1-2	4 1-4	1 1-4	11.00	16.75

Concave

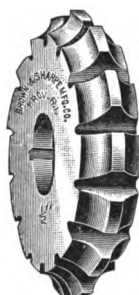
No.	Diameter of Circle, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
C-10A	1-8	2	7-8	\$3.35	\$5.00
C-11A	3-16	2	7-8	3.50	5.35
C-12A	1-4	2	7-8	3.80	5.70
C-13A	5-16	2 1-4	7-8	4.10	6.20
C-14A	3-8	2 1-4	7-8	4.25	6.40
C-15A	7-16	2 1-4	7-8	4.50	6.85
C-16A	1-2	2 1-4	7-8	4.80	7.30
C-17A	5-8	2 3-4	1	6.00	9.00
C-18A	3-4	3	1	7.00	10.60
C-19A	7-8	3 1-4	1	8.00	12.10
C-20A	1	3 1-4	1	8.15	12.40
C-21A	1 1-8	4	1 1-4	10.80	16.35
C-22A	1 1-4	4	1 1-4	11.40	17.25
C-23A	1 3-8	4 1-4	1 1-4	12.85	19.55
C-24A	1 1-2	4 1-4	1 1-4	13.90	21.10

For List of Keyways, see page 230.

Corner-Rounding Cutters



Left Hand



Double



Right Hand

These cutters have side as well as radial clearance and can be ground without changing their outline.

In ordering single cutters, state whether Right- or Left-Hand Cutters are wanted.

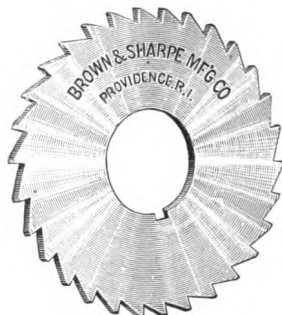
No.	Radius of Circle, Inches	Diameter, Inches	Hole, Inches	Carbon Steel Cutters		High-Speed Steel Cutters	
				Single Cutters Price each	Double Cutters Price each	Single Cutters Price each	Double Cutters Price each
C-100	1-16	2	7-8	\$2.45	\$3.10	\$3.70	\$4.75
C-102	1-8	2	7-8	3.20	3.35	4.85	5.00
C-104	3-16	2 1-4	7-8	3.45	3.90	5.25	5.85
C-106	1-4	2 1-4	7-8	3.80	4.25	5.70	6.40
C-107	5-16	2 3-4	1	4.65	5.35	7.00	8.10
C-108	3-8	3	1	5.25	6.40	8.00	9.70
C-109	7-16	3 1-4	1	6.20	7.25	9.35	11.00
C-110	1-2	3 1-4	1	6.45	7.65	9.75	11.65
C-112	5-8	3 1-2	1	7.70	8.85	11.70	13.45

For List of Keyways, see page 230.

Metal Slitting Saws

These are thin MILLING CUTTERS. They are ground on the sides and left a little thicker at the outer edge than near the centre to give a proper clearance in cutting deep slots.

In ordering *special* saws please state for what purpose they are required.



No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
G-50	2 1-2	1-32	7-8	\$1.30	\$2.50
G-51	2 1-2	3-64	7-8	1.20	2.40
G-52	2 1-2	1-16	7-8	1.15	2.35
G-53	2 1-2	3-32	7-8	1.15	2.35
G-54	2 1-2	1-8	7-8	1.15	2.35
G-55	2 1-2	5-32	7-8	1.40	2.60
G-56	3	1-32	1	1.60	2.95
G-57	3	3-64	1	1.45	2.60
G-58	3	1-16	1	1.30	2.50
G-59	3	3-32	1	1.30	2.50
G-60	3	1-8	1	1.30	2.50
G-61	3	5-32	1	1.50	2.85
G-62	4	1-32	1	2.85	4.60
G-63	4	3-64	1	1.85	3.15
G-64	4	1-16	1	1.60	2.95
G-65	4	3-32	1	1.55	2.85
G-66	4	1-8	1	1.55	2.85
G-67	4	5-32	1	1.80	3.45
G-68	4	3-16	1	2.10	3.45
G-69	5	1-16	1	2.30	3.85
G-70	5	3-32	1	2.00	3.35
G-71	5	1-8	1	2.00	3.35

List continued on next page.

For List of Keyways, see page 230.

Metal Slitting Saws

(Continued)

No.	Diameter, Inches	Thickness, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
G-72	5	1-8	1 1-4	\$2.00	\$3.35
G-73	5	1-8	1 1-2	2.00	3.35
G-74	5	5-32	1	2.45	4.30
G-75	5	3-16	1	2.90	4.30
G-76	6	1-16	1	5.10	7.50
G-77	6	3-32	1	3.85	5.85
G-78	6	1-8	1	3.45	5.35
G-78A	6	1-8	1 1-4	3.45	5.35
G-79	6	3-16	1 1-2	4.45	6.45
G-80	6	3-16	1	4.45	6.45
G-81	7	1-16	1	9.50	11.00
G-82	7	3-32	1	5.70	8.35
G-83	7	1-8	1	4.85	7.20
G-83A	7	3-16	1 1-4	6.50	9.05
G-83C	7	3-16	2	6.50	9.05
G-84	8	1-8	1	7.30	12.00
G-85	8	1-8	1 1-4	7.30	12.00
G-86	8	3-16	1 1-4	8.90	12.30
G-87	8	3-16	1 1-2	8.90	12.30

For List of Keyways, see page 230.

Formed Saws for Slitting Copper

These saws are designed especially for the slitting or sawing of metals that are of a soft or tenacious character and are superior to the ordinary saw usually employed for this purpose.

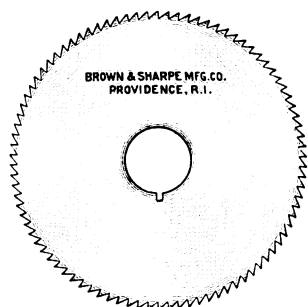
The teeth are backed off and formed the same as in all formed milling cutters, and are sharpened by grinding the face, thus retaining the outline of the saw. Each alternate tooth is V shaped, and, as the others are flat, the chip is split and forced out sideways, having less tendency to clog than where the ordinary saw is employed.

The sides are ground concave for clearance.

These saws are made to order of any desired size.

Prices on application.





Screw Slotting Cutters

These cutters have a fine pitch of teeth especially adapted to the slotting of screw heads and similar work.

They are not ground on the sides.

Cutters 2 3-4" diam. have 72 teeth, 2 1-4" diam., 60 teeth and 1 3-4" diam., 90 teeth.

Catalog No.	Diameter of Screw Head to be Slotted, Inches	Gauge No. American Standard	Thickness of Cutter, Inches	Diameter of Cutter, Inches	Hole, Inches	Price each
H-10	1 5-16	5	.182	2 3-4	1	\$.90
H-11	1 1-8	6	.162	2 3-4	1	.75
H-12	1	7	.144	2 3-4	1	.65
H-13	7-8	8	.128	2 3-4	3-4, 1	.55
H-14	3-4 to 13-16	9	.114	2 3-4	3-4, 1	.50
H-15	5-8	10	.102	2 3-4	3-4, 1	.45
H-16	...	11	.091	2 3-4	3-4, 1	.40
H-17	1-2 to 9-16	12	.081	2 3-4	3-4, 1	.35
H-18	...	13	.072	2 3-4	3-4, 1	.30
H-19	3-8 to 7-16	14	.064	2 3-4	1-2, 5-8, 3-4, 1	.30
H-20	11-32	15	.057	2 3-4	1-2, 5-8, 3-4, 1	.20
H-21	5-16	16	.051	2 3-4	1-2, 5-8, 3-4, 1	.20
H-22	...	17	.045	2 3-4	1-2, 5-8, 3-4, 1	.20
H-23	1-4 to 9-32	18	.040	2 3-4	1-2, 5-8, 3-4, 1	.20
H-24	3-16 to 7-32	19	.035	2 3-4	1-2, 5-8, 3-4, 1	.20
H-25	...	20	.032	2 3-4	1-2, 5-8, 3-4, 1	.20
H-26	1-8	21	.028	2 3-4	1-2, 5-8, 3-4, 1	.20
H-27	1-8	22	.025	2 3-4	1-2, 5-8, 3-4, 1	.20
H-28	...	23	.023	2 3-4	1-2, 5-8, 3-4, 1	.20
H-29	...	24	.020	2 3-4	1-2, 5-8, 3-4, 1	.20
H-30	...	25	.018	2 3-4	1-2, 5-8, 3-4, 1	.20
H-31	...	26	.016	2 3-4	3-4, 1	.20
H-32	...	27	.014	2 3-4	3-4, 1	.20
H-33	...	28	.012	2 3-4	3-4, 1	.20
H-34	...	30	.010	2 3-4	3-4, 1	.20
H-35	...	32	.008	2 3-4	3-4, 1	.20
H-36	...	34	.006	2 3-4	3-4, 1	.20
H-36A	...	10	.102	2 1-4	5-8	.40
H-36B	...	11	.091	2 1-4	5-8	.35
H-36C	...	12	.081	2 1-4	5-8	.30
H-36D	...	13	.072	2 1-4	5-8	.20
H-36E	...	14	.064	2 1-4	5-8	.20

List continued on next page.

For List of Keyways, see page 230.

Screw Slotting Cutters *(Continued)*

Catalog No.	Diameter of Screw Head to be Slotted, Inches	Gauge No. American Standard	Thickness of Cutter, Inches	Diameter of Cutter, Inches	Hole, Inches	Price each
H-36F	...	15	.057	2 1-4	5-8	\$.20
H-36G	...	16	.051	2 1-4	5-8	.20
H-36H	...	17	.045	2 1-4	5-8	.20
H-36I	...	18	.040	2 1-4	5-8	.20
H-36J	...	19	.035	2 1-4	5-8	.20
H-37	3-16	20	.032	2 1-4	5-8	.20
H-38	1-8	21	.028	2 1-4	5-8	.20
H-39	...	22	.025	2 1-4	5-8	.20
H-40	...	23	.023	2 1-4	5-8	.20
H-41	...	24	.020	2 1-4	5-8	.20
H-42	...	25	.018	2 1-4	5-8	.20
H-43	...	26	.016	2 1-4	5-8	.20
H-44	...	27	.014	2 1-4	5-8	.20
H-45	...	28	.012	2 1-4	5-8	.20
H-46	...	30	.010	2 1-4	5-8	.20
H-47	...	32	.008	2 1-4	5-8	.20
H-48	...	34	.006	2 1-4	5-8	.20
H-49	3-8	14	.064	1 3-4	5-8	.20
H-50	11-32	15	.057	1 3-4	5-8	.20
H-51	5-16	16	.051	1 3-4	5-8	.20
H-52	9-32	17	.045	1 3-4	5-8	.20
H-53	1-4	18	.040	1 3-4	5-8	.20
H-54	7-32	19	.035	1 3-4	5-8	.20
H-55	3-16	20	.032	1 3-4	5-8	.20
H-56	1-8	21	.028	1 3-4	5-8	.20
H-57	...	22	.025	1 3-4	5-8	.20
H-58	...	23	.023	1 3-4	5-8	.20
H-59	...	24	.020	1 3-4	1-2, 5-8	.15
H-60	...	25	.018	1 3-4	1-2, 5-8	.15
H-61	...	26	.016	1 3-4	1-2, 5-8	.15
H-62	...	27	.014	1 3-4	1-2, 5-8	.15
H-63	...	28	.012	1 3-4	1-2, 5-8	.15
H-64	...	30	.010	1 3-4	1-2, 5-8	.15
H-65	...	32	.008	1 3-4	1-2, 5-8	.15
H-66	...	34	.006	1 3-4	1-2, 5-8	.15

Cutters varying from the above list are made to order.

For Screw Slotting Cutter Arbors, see page 288.

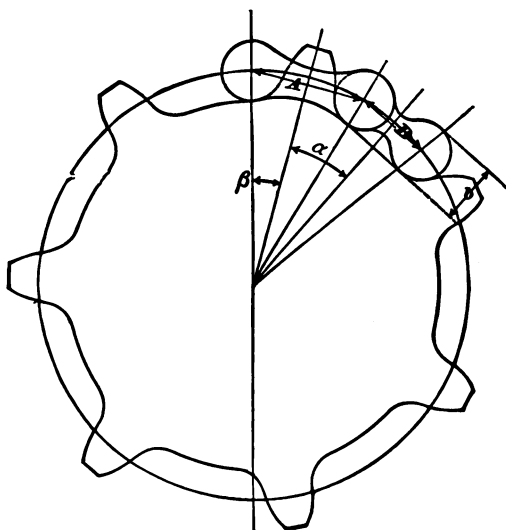
For List of Keyways, see page 230.

Jewelers' Saws

Many of the Screw Slotting Cutters listed above are suitable for jewelers' use in sawing chain links, etc.

Formula

**For Calculating Diameters of Sprocket Wheels for
Block Centre Chains**



N = No. of Teeth

$$a = \frac{180^\circ}{N}$$

**b = Diameter of Round Part of
Chain Block**

**B = Centre to Centre of holes
in Chain Block**

$$\tan \beta = \frac{\sin a}{\frac{B}{A} + \cos a}$$

**A = Centre to Centre of holes
in Side Links**

$$\text{Pitch Diam.} = \frac{A}{\sin \beta}$$

$$\text{Outside Diameter} = \text{Pitch Diameter} + b$$

$$\text{Bottom Diameter} = \text{Pitch Diameter} - b$$

In calculating the diameter of Sprocket Wheels the Bottom Diameter is the more important.

Diameter of Sprocket Wheels

FOR BLOCK CHAINS 1" PITCH

$$A = .6" \quad B = .4" \quad b = .325"$$

No. of Teeth	Pitch Diameter, Inches	Outside Diameter, Inches	Bottom Diameter, Inches
6	1.935	2.260	1.610
7	2.250	2.575	1.925
8	2.566	2.891	2.241
9	2.882	3.207	2.557
10	3.198	3.523	2.873
11	3.515	3.840	3.190
12	3.832	4.157	3.507
13	4.149	4.474	3.824
14	4.466	4.791	4.141
15	4.784	5.109	4.459
16	5.102	5.427	4.777
17	5.420	5.745	5.095
18	5.738	6.063	5.413
19	6.056	6.381	5.731
20	6.374	6.699	6.049
21	6.692	7.017	6.367
22	7.010	7.335	6.685
23	7.328	7.653	7.003
24	7.646	7.971	7.321
25	7.964	8.289	7.639
26	8.282	8.607	7.957
27	8.600	8.925	8.275
28	8.918	9.243	8.593
29	9.237	9.562	8.912
30	9.556	9.881	9.231

Sprocket Wheel Cutters for Block Chains can be furnished at short notice.

Sprocket Wheel Cutters

FOR ROLLER CHAINS

Not carried in stock, but can be furnished at short notice.

Circular Pitch, Inches	Diameter of Roll, Inches	Diameter of Cutter, Inches	Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
1-2	.306 or .308	2 7-8	1	\$7.60	\$9.00
5-8	.401	3	1	7.90	9.60
3-4	*.470	3 1-4	1	8.25	10.30
15-16	.5625	3 3-8	1	8.85	11.65
1	.5625 or *.625	3 1-2	1	8.85	11.65
1 1-4	.625 or *.750	3 3-4	1 1-4	9.50	12.95
1 1-2	.750 or *.875	4 1-2	1 1-4	10.10	14.85
1 3-4	*1.	4 3-4	1 1-4	12.65	20.00
2	*1.125	5	1 1-4	15.20	24.00

* "Whitney Standard."

Nine Cutters are made for each pitch, for Nos. of teeth as follows: 8, 9, 10 and 11, 12 and 13, 14 to 16, 17 to 20, 21 to 34, 35 to 79, 80 and over.

In ordering, specify the number of teeth in the sprocket, and the diameter of the roller.

Formula

For Calculating Diameters of Sprocket Wheels For Roller Chains

N = Number of Teeth in Sprocket

P = Pitch of Chain

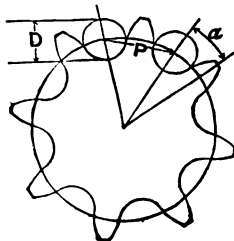
D = Diameter of Roller

$$\alpha = \frac{180^\circ}{N}$$

$$\text{Pitch Diameter} = \frac{P}{\sin \alpha}$$

$$\text{Outside Diameter} = \text{Pitch Diameter} + D$$

$$\text{Bottom Diameter} = \text{Pitch Diameter} - D$$



Patent Cutters

Which can be Sharpened by Grinding without Changing Their Form

FOR THE TEETH OF GEAR WHEELS



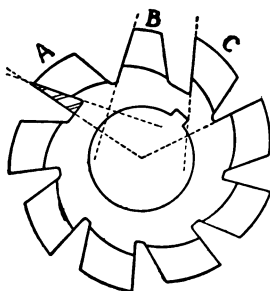
The Patent Cutters for the Teeth of Gear Wheels, from their peculiar construction, can be sharpened by grinding the faces of the teeth. This operation can be repeated without altering the form of the tooth which the cutter makes, thereby rendering them much more valuable than cutters of ordinary form.

Cutters marked * are not kept in stock, but are made to order at short notice.

Orders should be given by the following tables, stating the number of cutter and the diametral pitch required. By diametral pitch is meant the number of teeth to the inch in diameter on pitch circle of any wheel. In ordering cutters for worm wheels, give the number of teeth in wheel, the diameter of worm, and number of threads to the inch.

Centre Line on Gear Cutters. We call attention to the centre line on our Gear Cutters, which is convenient in setting cutters central with the work spindle.

Sharpening Gear and Formed Cutters



FOR economy, cutters must be kept well sharpened. Sharp cutters give faster production, consume less power, produce better surfaces and wear longer. Use a bevel and concave wheel of medium grain and soft grade, just hard enough to prevent the grit flying about. Keep the wheel clean, as a glazed wheel draws the cutter temper, also keep the corner sharp to give a true surface the entire length of the cutter tooth.

In grinding the cutter, the face of every tooth must be kept radial, and all must be of the same height. When not ground radially, they are either "hooking," like C which cuts too deep, or "dragging," as B which cuts too shallow. Besides this, all cutter teeth are relieved so that the cutting outline of the tooth remains correct only when ground radially. Hence such teeth as A, B and C will cut gear teeth of the wrong shape. Be careful also to keep each tooth face square with the sides of the cutter, avoiding mistakes like A. If some of the teeth are longer than others, the long teeth will do all the cutting. In this connection the Cutter Testing Fixture shown on page 353 will be found of particular value.

To Set a Gear Cutter Central

THE indicator furnished with our Automatic Gear Cutting Machine allows settings sufficiently accurate for ordinary work. When a very accurate and quiet-running gear is required, however, it is absolutely essential that the cutter be exactly central.

The best method of setting the cutter central is first to turn a blank identical in diameter with the gear to be cut, and, after centring it as nearly as possible, take a single cut through the blank. Without changing the position of the cutter, remove the blank from the work arbor and turn it end for end. Leave the blank loose on the arbor and feed the cutter into the slot already cut. Then revolve the cutter by pulling the belt so as to mark its position in relation to the slot produced at the first cut.

If the cutter is exactly central, the second cut will follow the outline of the first; but if out of centre, the cutter at its second passage will cut some stock from the top of the space on one side and from the bottom on the other side. In the latter case the cutter should be moved laterally away from the side of the tooth from which the stock was taken at the deepest part of cut and another cut taken in another part of the blank, and the above operations repeated until the cutter is properly centred.

Patent Involute Cutters

FOR TEETH OF GEAR WHEELS

Eight Cutters are made for each pitch, as follows:

No. 1	will cut wheels from 135 teeth to a rack
" 2	" " " " 55 to 134 teeth
" 3	" " " " 35 " 54 "
" 4	" " " " 26 " 34 "
" 5	" " " " 21 " 25 "
" 6	" " " " 17 " 20 "
" 7	" " " " 14 " 16 "
" 8	" " " " 12 " 13 "

We are prepared to furnish to order Gear Cutters from 2 to 8 pitch, inclusive of half numbers, for the accommodation of those who require a finer division of the number of teeth to be cut with each cutter than can be cut with the regular number.

The Nos. 1 to 8, as listed above, are the regular cutters as furnished heretofore. The half numbers are as follows:

No. of Cutter	Range, Teeth	No. of Cutter	Range, Teeth
1 1-2	80 to 134	5 1-2	19 to 20
2 1-2	42 " 54	6 1-2	15 " 16
3 1-2	30 " 34	7 1-2	13
4 1-2	23 " 25		

Prices for half numbers on application.

In ordering, give the number of cutter and diametral pitch required. Cutters in stock can be ordered by telegraph.

Form of Telegram:— *Send one Cutter No. 5, 8 pitch (Carbon Steel or High-Speed Steel).*

When ordering Cutters for Bevel Gears note instructions given on pages 258 and 259.

Patent Involute Cutters

FOR TEETH OF GEAR WHEELS

All gears of same pitch cut with these cutters are interchangeable.

Pitch	Diameter of Cutter, Inches		Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Sp'd Steel			
*1	8 1-2	8 1-2	2	\$57.00	\$85.00
*1 1-4	7 3-4	7 3-4	2	48.00	70.00
*1 1-2	7	7	1 3-4	40.50	55.00
1 3-4	6 1-2	6 1-2	1 3-4	30.35	45.00
2	5 3-4	5 3-4	1 1-2	20.25	35.00
2 1-2	5 1-2	5 3-4	1 1-2	13.90	23.00
3	4 3-8	4 3-4	1 1-4	10.10	18.00
4	3 7-8	4 1-4	1 1-4	7.60	12.00
5	3 5-8	3 3-4	1 1-4	6.35	10.00
6	3	3 1-8	1	5.45	8.00
7	2 7-8	2 7-8	1	5.15	7.00
8	2 7-8	2 7-8	1	5.00	6.00
9	2 3-4	2 3-4	1	4.70	5.50
10	2 1-4	2 3-8	7-8	4.45	5.00
11	2 1-4	2 3-8	7-8	4.20	4.50
12	2 1-8	2 1-4	7-8	3.90	4.25
14	2	2 1-8	7-8	3.40	3.75
16	2	2 1-8	7-8	3.20	3.50
18	1 7-8	2	7-8	3.00	3.40
20	1 7-8	2	7-8	2.90	3.30
22	1 7-8	2	7-8	2.80	3.20
24	1 3-4	1 3-4	7-8	2.65	3.10
26	1 3-4	1 3-4	7-8	2.55	3.00
28	1 3-4	1 3-4	7-8	2.25	3.00
30	1 3-4	1 3-4	7-8	2.25	3.00
32	1 3-4	1 3-4	7-8	2.25	3.00
36	1 3-4	1 3-4	7-8	2.25	3.00
40	1 3-4	1 3-4	7-8	2.25	3.00
48	1 3-4	1 3-4	7-8	2.25	3.00

Cutters marked * are not kept in stock, but are made to order.

Cutters for pitches not given in the above list will be made to order.

Eight cutters made for each pitch; see page 249.

For List of Keyways, see page 230.

KEEP CUTTERS SHARP



Patent Involute Cutters

FOR TEETH OF GEAR WHEELS

For Use on

No. 3 Automatic Gear Cutting Machines

Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel				
4	3 1-2	3 5-8	1	5-32 x 5-64	\$7.00	\$12.00
5	3 1-4	3 3-8	1	5-32 x 5-64	6.00	10.00
6	3	3 1-8	1	5-32 x 5-64	5.45	8.00
7	2 7-8	2 7-8	1	5-32 x 5-64	5.15	7.00
8	2 7-8	2 7-8	1	5-32 x 5-64	5.00	6.00
9	2 3-4	2 3-4	1	5-32 x 5-64	4.70	5.50
10	2 3-4	2 3-4	1	5-32 x 5-64	4.55	5.30
11	2 5-8	2 5-8	1	5-32 x 5-64	4.45	4.95
12	2 5-8	2 5-8	1	5-32 x 5-64	4.25	4.70
14	2 1-2	2 1-2	1	5-32 x 5-64	3.75	4.15
16	2 1-2	2 1-2	1	5-32 x 5-64	3.45	3.85
18	2 3-8	2 3-8	1	5-32 x 5-64	3.35	3.75
20	2 3-8	2 3-8	1	5-32 x 5-64	3.25	3.65
22	2 1-4	2 1-4	1	5-32 x 5-64	3.10	3.55
24	2 1-4	2 1-4	1	5-32 x 5-64	3.00	3.45

For Use on

Nos. 3H and 4 Automatic Gear Cutting Machines

Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel				
3	4 3-8	4 3-4	1 1-4	3-16 x 3-32	\$10.10	\$18.00
4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	7.60	12.00
5	3 5-8	3 3-4	1 1-4	3-16 x 3-32	6.35	10.00
6	3 1-2	3 1-2	1 1-4	3-16 x 3-32	6.00	8.40
7	3 3-8	3 3-8	1 1-4	3-16 x 3-32	5.85	8.00
8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	5.55	7.30
9	3 1-8	3 1-8	1 1-4	3-16 x 3-32	5.35	6.65
10	3	3	1 1-4	3-16 x 3-32	5.00	6.00
11	2 7-8	2 7-8	1 1-4	3-16 x 3-32	4.80	5.40
12	2 7-8	2 7-8	1 1-4	3-16 x 3-32	4.55	5.10

Cutters for pitches not given in the above list will be made to order. Eight cutters made for each pitch, see page 249. 3 pitch and coarser in Cast Iron and 4 pitch and coarser in Steel require 2 cuts to insure accuracy. For List of Keyways, see page 230.

KEEP CUTTERS SHARP

Patent Involute Cutters

FOR TEETH OF GEAR WHEELS

For Use on No. 5 Automatic Gear Cutting Machines

Pitch	Diameter of Cutter		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel, Inches	High-Speed Steel, Inches				
2	5 3-4	5 3-4	1 1-2	5-16 x 5-32	\$20.25	\$35.00
2 1-2	5 1-2	5 3-4	1 1-2	5-16 x 5-32	13.90	23.00
3	5	5 1-4	1 1-2	5-16 x 5-32	11.40	19.00
4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	8.25	13.20
5	4	4 1-4	1 1-2	5-16 x 5-32	7.00	11.00
6	3 3-4	3 7-8	1 1-2	5-16 x 5-32	6.70	9.00
7	3 5-8	3 5-8	1 1-2	5-16 x 5-32	6.45	8.25
8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	6.20	7.50

For Use on No. 6 Automatic Gear Cutting Machines

Pitch	Diameter of Cutter		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel, Inches	High-Speed Steel, Inches				
1 3-4	6 1-2	6 1-2	1 3-4	3-8 x 3-16	\$30.35	\$45.00
2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	21.50	42.00
2 1-2	5 7-8	6 1-8	1 3-4	3-8 x 3-16	14.60	26.00
3	5 3-8	5 5-8	1 3-4	3-8 x 3-16	12.00	22.00
4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	8.85	14.40
5	4 3-8	4 3-8	1 3-4	3-8 x 3-16	7.60	12.00
6	4 1-4	4 1-4	1 3-4	3-8 x 3-16	7.30	10.40

Cutters for Mitre and Bevel Gears

For Use on No. 13 Automatic Gear Cutting Machines

Pitch	Diameter of Cutter		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel, Inches	High-Speed Steel, Inches				
4	3 3-8	3 1-2	7-8	1-8 x 1-16	\$7.00	\$12.00
5	3 1-8	3 1-4	7-8	1-8 x 1-16	6.00	10.00
6	3	3 1-8	7-8	1-8 x 1-16	5.45	8.00
7	2 3-4	2 7-8	7-8	1-8 x 1-16	5.15	7.00
8	2 3-4	2 7-8	7-8	1-8 x 1-16	5.00	6.00
10	2 5-8	2 5-8	7-8	1-8 x 1-16	4.55	5.30
12	2 1-2	2 1-2	7-8	1-8 x 1-16	4.25	4.70
14	2 3-8	2 3-8	7-8	1-8 x 1-16	3.75	4.15
16	2 3-8	2 3-8	7-8	1-8 x 1-16	3.45	3.85
20	2 1-4	2 1-4	7-8	1-8 x 1-16	3.25	3.65
24	2 1-4	2 1-4	7-8	1-8 x 1-16	3.00	3.45

Cutters for pitches not given in the above list will be made to order. Eight cutters made for each pitch, page 249. 3 pitch and coarser in Cast Iron and 4 pitch and coarser in Steel require 2 cuts to insure accuracy. See pages 253-259 for directions and tables for selecting bevel gear cutters.

KEEP CUTTERS SHARP

Table for Selecting Cutters for Bevel Gears with Axes at Right Angles Only

SELECTION OF CUTTERS

The following tables are for use in selecting cutters for cutting bevel gears. The various numbers of teeth in gear and pinion are given, and at the intersection of the two columns will be found the numbers of the cutters required.

EXAMPLE.—Required cutters for a pair of bevel gears, 8 pitch; gear 24 teeth, pinion 12 teeth.

In column at left of table, page 254, will be found 24 teeth, and in column at top of 12 teeth; at the intersection of these two columns will be found the numbers of the cutters, in this case No. 3 for the gear and No. 8 for the pinion.

Number of cutter for gear given first, followed by number for pinion.

CUTTERS FOR USE IN CUTTING BEVEL GEARS

PINION

GEAR

	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
12	7-7																		
13	6-7	6-6																	
14	5-7	6-6	6-6																
15	5-7	5-6	5-6	5-5															
16	4-7	5-7	5-6	5-6	5-5														
17	4-7	4-7	4-6	5-6	5-5	5-5													
18	4-7	4-7	4-6	4-6	4-5	4-5	5-5												
19	3-7	4-7	4-6	4-6	4-6	4-5	4-5	4-4											
20	3-7	3-7	4-6	4-6	4-6	4-5	4-5	4-4	4-4										
21	3-8	3-7	3-7	3-6	4-6	4-5	4-5	4-5	4-4	4-4									
22	3-8	3-7	3-7	3-6	3-6	3-5	4-5	4-5	4-4	4-4	4-4								
23	3-8	3-7	3-7	3-6	3-6	3-5	3-5	3-5	3-4	4-4	4-4	4-4							
24	3-8	3-7	3-7	3-6	3-6	3-6	3-5	3-5	3-4	3-4	3-4	4-4	4-4						
25	2-8	2-7	3-7	3-6	3-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	4-4	3-3					
26	2-8	2-7	3-7	3-6	3-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-3	3-3				
27	2-8	2-7	2-7	2-6	3-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-4	3-3	3-3			
28	2-8	2-7	2-7	2-6	2-6	3-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-4	3-3	3-3	3-3		
29	2-8	2-7	2-7	2-7	2-6	2-6	3-5	3-5	3-5	3-4	3-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3	
30	2-8	2-7	2-7	2-7	2-6	2-6	2-5	2-5	3-5	3-5	3-4	3-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3
31	2-8	2-7	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	3-4	3-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3
32	2-8	2-7	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	3-4	3-4	3-4	3-3	3-3	3-3	3-3
33	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	3-4	3-4	3-4	3-3	3-3	3-3
34	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	3-4	3-3	3-3	3-3
35	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-3	3-3
36	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3	2-3
37	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3	2-3
38	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-3
39	2-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-3
40	1-8	2-8	2-7	2-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-3
41	1-8	1-8	2-7	2-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-3
42	1-8	1-8	2-7	2-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
43	1-8	1-8	1-7	2-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
44	1-8	1-8	1-7	1-7	2-6	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
45	1-8	1-8	1-7	1-7	1-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
46	1-8	1-8	1-7	1-7	1-7	2-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
47	1-8	1-8	1-7	1-7	1-7	1-6	2-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
48	1-8	1-8	1-7	1-7	1-7	1-6	1-6	2-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
49	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
50	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	2-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-3
51	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	2-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4
52	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	2-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4
53	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	1-5	2-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4
54	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	1-5	1-5	2-4	2-4	2-4	2-4	2-4	2-4	2-4
55	1-8	1-8	1-7	1-7	1-7	1-6	1-6	1-6	1-5	1-5	1-5	1-5	1-4	2-4	2-4	2-4	2-4	2-4	2-4

CUTTERS FOR USE IN CUTTING BEVEL GEARS—(Continued)

GEAR	PINION																			
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
26	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
27	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
28	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
29	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
30	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
31	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
32	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
33	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
34	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
35	1-4	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
36	1-4	1-3	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
37	1-4	1-3	1-3	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
38	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
39	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
40	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
41	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
42	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
43	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
44	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
45	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
46	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
47	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
48	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
49	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2
50	1-4	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	2-2	2-2	2-2	2-2	2-2	2-2	2-2

Cutters for Mitre and Bevel Gears

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
3	4	4	1 1-4	\$9.50	\$15.00
4	3 1-2	3 5-8	1 1-4	7.00	12.00
5	3 1-4	3 3-8	1 1-4	6.00	10.00
6	3	3 1-8	1	5.45	8.00
7	2 7-8	2 7-8	1	5.15	7.00
8	2 7-8	2 7-8	1	5.00	6.00
10	2 1-4	2 3-8	7-8	4.45	5.00
12	2 1-8	2 1-4	7-8	3.90	4.25
14	2	2 1-8	7-8	3.40	3.75
16	2	2 1-8	7-8	3.20	3.50
20	1 7-8	2	7-8	2.90	3.30
24	1 3-4	1 3-4	7-8	2.65	3.10

For List of Keyways, see page 230.

Cutters for pitches not given in the above list will be made to order.

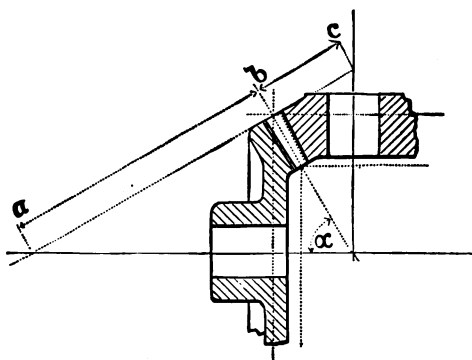
These cutters are thin enough to cut any bevel gear whose tooth face is not longer than one-third the distance from its outer end to the point where the shaft centre-lines meet. This makes the tooth thickness at the inner end not less than two-thirds that at the outer end.

In ordering cutters for bevel gears, if the number of teeth in each gear, the pitch and length of face are given, also the angle of the shafts, if different from a right angle, we can select the proper cutter to send.

Eight cutters are made for each pitch and are numbered from 1 to 8.

As the number of teeth in the bevel gears to be cut with each cutter will not always agree with the list on page 249 the number of cutter must be found for each pair of gears to be cut according to the diagram or formula on next page.

See pages 253 to 257 for directions and tables for selecting bevel gear cutters.



N_a = No. of Teeth in Gear

N_b = No. of Teeth in Pinion

α = Centre Angle of Gear

Measure the back cone radius $a b$ for the gear, or $b c$ for the pinion. This is equal to the radius of a spur gear, the number of teeth in which would determine the cutter to use. Hence twice $a b$ times the diametral pitch equals the number of teeth for which the cutter should be selected for the gear. Looking in the list on page 249, the proper number for the cutter can be found.

Thus let the back cone radius $a b$ be 4" and the diametral pitch be 8. Twice 4 is 8, and 8×8 is 64, from which it can be seen that the cutter must be of shape No. 2, as 64 is between 55 and 134, the range covered by No. 2 cutter.

The number of teeth for which the cutter should be selected can also be found by the following formula:

$$\tan \alpha = \frac{N_a}{N_b}$$

$$\text{No. of teeth to select cutter for gear} = \frac{N_a}{\cos \alpha}$$

$$\text{No. of teeth to select cutter for pinion} = \frac{N_b}{\sin \alpha}$$

If the gears are mitres or are alike, only one cutter is needed; if one gear is larger than the other, two may be needed.

Additional helps on this subject can be found in B & S "Practical Treatise on Gearing" and "Formulas in Gearing."

For List of Publications, see page 8

Patent Involute Cutters

FOR TEETH OF GEAR WHEELS

LARGE DIAMETERS

Pitch	Diameter of Cutter, Inches		Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
1	8 1-2	8 1-2	1 1-2 or 2	\$57.00	\$85.00
1 1-4	7 3-4	7 3-4	1 1-2 or 2	48.00	70.00
1 1-2	7 1-4	7 1-4	1 1-2 or 2	41.75	60.00
1 3-4	6 3-4	6 3-4	1 1-2 or 2	31.65	54.00
2	6 1-4	6 1-4	1 1-2 or 2	20.90	38.50
2 1-4	6 1-4	6 1-4	1 1-2 or 2	17.10	30.80
2 1-2	6 1-4	6 1-4	1 1-2 or 2	15.20	26.50
2 3-4	5 3-4	6 1-4	1 1-2 or 2	13.30	25.00
3	5 1-4	5 1-4	1 1-2 or 2	12.05	19.00
4	5 1-4	5 1-4	1 1-2 or 2	10.10	15.85
5	5 1-4	5 1-4	1 1-2 or 2	8.85	14.20
6	4 1-4	4 1-4	1 1-2 or 2	7.30	10.40
7	4 1-4	4 1-4	1 1-2 or 2	7.10	9.10
8	4 1-4	4 1-4	1 1-2 or 2	6.80	8.60
10	4 1-4	4 1-4	1 1-2 or 2	6.60	7.80
12	4 1-4	4 1-4	1 1-2 or 2	5.50	6.65
14	4 1-4	4 1-4	1 1-2 or 2	5.00	6.00
16	4 1-4	4 1-4	1 1-2 or 2	5.00	6.00

For the above Cutters with 1 1-2" hole the Keyways are 3-8" wide and 3-16" deep; with 2" hole the Keyways are 1-2" wide and 3-16" deep.

Cutters for pitches not given in the above list will be made to order.

KEEP CUTTERS SHARP

Formulas

For Determining the Dimensions of Gears By Metric Pitch

Module is the pitch diameter in millimetres divided by the number of teeth in the gear.

Pitch diameter in millimetres is the Module multiplied by the number of teeth in the gear.

M = Module

D' = The pitch diameter of gear in millimetres

D = The whole diameter of gear in millimetres

N = The number of teeth in gear

D'' = The working depth of teeth

t = Thickness of teeth on pitch line

f = Amount added to depth for clearance

Then

$$M = \frac{D'}{N} \text{ or } \frac{D}{N+2}$$

$$D' = N M$$

$$D = (N+2) M$$

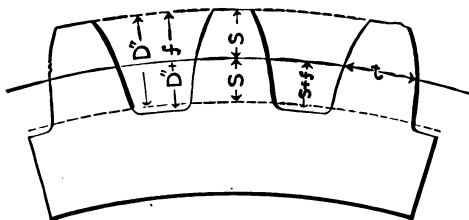
$$N = \frac{D'}{M} \text{ or } \frac{D}{M} - 2$$

$$D'' = 2 M$$

$$t = M 1.5708$$

$$f = \frac{M 1.5708}{10} = .157 M$$

The Module is equal to the part marked "S" in cut, on next page, measured in millimetres and parts of millimetres.



Pitches Commonly Used

Module in Millimetres

Module, m/m	Corresponding English Diametral Pitch	Module, m/m	Corresponding English Diametral Pitch
0.5	50.800	5	5.080
0.75	33.867	5.5	4.618
1	25.400	6	4.233
1.25	20.320	7	3.628
1.5	16.933	8	3.175
1.75	14.514	9	2.822
2	12.700	10	2.540
2.25	11.288	11	2.309
2.5	10.160	12	2.117
2.75	9.236	13	1.954
3	8.466	14	1.814
3.5	7.257	15	1.693
4	6.350	16	1.587
4.5	5.644	..	....

Patent Metric Involute Cutters

FOR TEETH OF GEAR WHEELS

We are prepared to furnish, at short notice, cutters for cutting the teeth of Gear Wheels according to the Metric system.

Module is the Pitch Diameter in millimetres divided by the number of teeth in the gear.

Pitch Diameter in millimetres is the Module multiplied by the number of teeth in the gear.

M = Module

D' = Pitch Diameter in m/m

N = No. of Teeth in Gear

D' = M × N

For example: M = 3.50 m/m; N = 100; D' = 3.50 × 100 = 350 m/m

Further explanation, page 261.

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
1-2	1 3-4	1 3-4	7-8" or 22m/m	\$2.90	\$3.00
3-4	1 3-4	1 3-4	7-8 or 22	2.90	3.00
1	1 3-4	1 3-4	7-8 or 22	3.30	3.10
1 1-4	1 7-8	2	7-8 or 22	3.50	3.30
1 1-2	2	2 1-8	7-8 or 22	3.80	3.50
1 3-4	2	2 1-8	7-8 or 22	4.00	3.75
2	2 1-8	2 1-4	7-8 or 22	4.55	4.25
2 1-4	2 1-4	2 3-8	7-8 or 22	4.80	4.50
2 1-2	2 1-4	2 3-8	7-8 or 22	5.00	5.00
2 3-4	2 3-4	2 3-4	1 or 27	5.35	5.50
3	2 7-8	2 7-8	1 or 27	5.55	6.00
3 1-4	2 7-8	2 7-8	1 or 27	5.55	6.00
3 1-2	2 7-8	2 7-8	1 or 27	5.85	7.00
3 3-4	2 7-8	2 7-8	1 or 27	5.85	7.00
4	3	3 1-8	1 or 27	6.00	8.00
4 1-4	3	3 1-8	1 or 27	6.00	8.00
4 1-2	3 5-8	3 3-4	1 1-4 or 32	7.00	9.00
4 3-4	3 5-8	3 3-4	1 1-4 or 32	7.00	9.00
5	3 5-8	3 3-4	1 1-4 or 32	7.00	10.00
5 1-4	3 5-8	3 3-4	1 1-4 or 32	7.00	10.00
5 1-2	3 3-4	4	1 1-4 or 32	7.60	11.00
5 3-4	3 3-4	4	1 1-4 or 32	7.60	11.00
6	3 7-8	4 1-4	1 1-4 or 32	8.25	12.00
7	4 1-8	4 1-2	1 1-4 or 32	9.20	14.00
8	4 3-8	4 3-4	1 1-4 or 32	10.80	18.00
9	5 1-8	5 1-2	1 1-2 or 40	13.30	20.00
10	5 1-2	5 3-4	1 1-2 or 40	14.60	23.00
11	5 3-4	5 3-4	1 1-2 or 40	17.10	28.00
12	5 3-4	5 3-4	1 1-2 or 40	20.90	35.00

Cutters for pitches not given in the above list will be made to order.

Eight cutters made for each pitch, page 249. List of Keyways, page 230.

KEEP CUTTERS SHARP

Patent Metric Involute Cutters

FOR TEETH AND GEAR WHEELS

For Use on

No. 3 Automatic Gear Cutting Machines

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
3-4	2 1-4	2 1-4	1" or 27 m/m	\$3.25	\$3.30
1	2 1-4	2 1-4	1 or 27	3.65	3.45
1 1-4	2 3-8	2 3-8	1 or 27	3.85	3.65
1 1-2	2 1-2	2 1-2	1 or 27	4.15	3.85
1 3-4	2 1-2	2 1-2	1 or 27	4.35	4.15
2	2 5-8	2 5-8	1 or 27	4.90	4.70
2 1-4	2 5-8	2 5-8	1 or 27	5.05	4.95
2 1-2	2 3-4	2 3-4	1 or 27	5.15	5.30
3	2 7-8	2 7-8	1 or 27	5.55	6.00
3 1-2	2 7-8	2 7-8	1 or 27	5.85	7.00
4	3	3 1-8	1 or 27	6.00	8.00
4 1-2	3 1-8	3 1-4	1 or 27	6.35	9.00
5	3 1-4	3 3-8	1 or 27	6.65	10.00
5 1-2	3 3-8	3 1-2	1 or 27	7.00	11.00
6	3 1-2	3 5-8	1 or 27	7.60	12.00

For Use on

Nos. 3H & 4 Automatic Gear Cutting Machines

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
1 1-4	2 3-4	2 3-4	1 1-4" or 32 m/m	\$4.20	\$4.00
1 1-2	2 7-8	2 7-8	1 1-4 or 32	4.45	4.20
1 3-4	2 7-8	2 7-8	1 1-4 or 32	4.70	4.50
2	2 7-8	2 7-8	1 1-4 or 32	5.15	5.10
2 1-4	2 7-8	2 7-8	1 1-4 or 32	5.45	5.40
2 1-2	3	3	1 1-4 or 32	5.70	6.00
3	3 1-4	3 1-4	1 1-4 or 32	6.20	7.30
3 1-2	3 3-8	3 3-8	1 1-4 or 32	6.45	8.00
4	3 1-2	3 1-2	1 1-4 or 32	6.70	8.40
4 1-2	3 5-8	3 3-4	1 1-4 or 32	7.00	9.00
5	3 5-8	3 3-4	1 1-4 or 32	7.00	10.00
5 1-2	3 3-4	4	1 1-4 or 32	7.60	11.00
6	3 7-8	4 1-4	1 1-4 or 32	8.25	12.00
7	4 1-8	4 1-2	1 1-4 or 32	9.20	14.00
8	4 3-8	4 3-4	1 1-4 or 32	10.80	18.00

Cutters for pitches not given in the above list will be made to order.
Eight cutters made for each pitch. See page 249.
For List of Keyways, see page 230.

KEEP CUTTERS SHARP

Patent Metric Involute Cutters

FOR TEETH OF GEAR WHEELS

For Use on

No. 5 Automatic Gear Cutting Machines

Module, m/m	Diameter of Cutter, Inches		Size of Hole	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
2 1-2	3 1-2	3 1-2	1 1-2" or 40m/m	\$6.60	\$6.50
3	3 1-2	3 1-2	1 1-2 or 40	6.80	7.50
3 1-2	3 5-8	3 5-8	1 1-2 or 40	7.10	8.25
4	3 3-4	3 7-8	1 1-2 or 40	7.30	9.00
4 1-2	3 7-8	4 1-8	1 1-2 or 40	7.60	10.00
5	4	4 1-4	1 1-2 or 40	7.60	11.00
5 1-2	4 1-8	4 3-8	1 1-2 or 40	8.25	12.10
6	4 1-4	4 1-2	1 1-2 or 40	8.85	13.20
7	4 5-8	4 7-8	1 1-2 or 40	10.10	15.40
8	5	5 1-4	1 1-2 or 40	12.00	19.00
9	5 1-8	5 1-2	1 1-2 or 40	13.30	20.00
10	5 1-2	5 3-4	1 1-2 or 40	14.60	23.00
11	5 3-4	5 3-4	1 1-2 or 40	17.10	28.00
12	5 3-4	5 3-4	1 1-2 or 40	20.90	35.00

For Use on

No. 6 Automatic Gear Cutting Machines

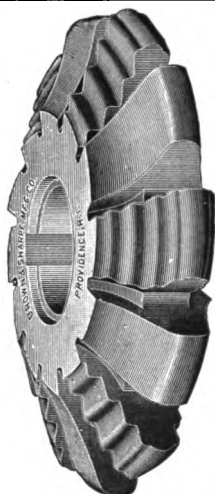
Module, m/m	Diameter of Cutter, Inches		Size of Hole	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
3	4	4	1 3-4" or 45m/m	\$7.50	\$7.80
3 1-2	4 1-8	4 1-8	1 3-4 or 45	7.70	9.10
4	4 1-4	4 1-4	1 3-4 or 45	8.00	10.40
4 1-2	4 3-8	4 3-8	1 3-4 or 45	8.25	10.80
5	4 3-8	4 3-8	1 3-4 or 45	8.25	12.00
5 1-2	4 1-2	4 5-8	1 3-4 or 45	8.85	13.20
6	4 5-8	4 3-4	1 3-4 or 45	9.50	14.40
7	5	5 1-4	1 3-4 or 45	10.45	16.80
8	5 3-8	5 5-8	1 3-4 or 45	12.65	22.00
9	5 5-8	5 7-8	1 3-4 or 45	13.90	23.00
10	5 7-8	6 1-8	1 3-4 or 45	15.20	26.00
11	6 1-4	6 1-2	1 3-4 or 45	17.70	33.60
12	6 1-2	6 1-2	1 3-4 or 45	22.15	42.00

Cutters for pitches not given in the above list made to order.

Eight cutters made for each pitch, see page 249.

For List of Keyways, see page 230.

KEEP CUTTERS SHARP



Improved Stocking Cutters

FOR INVOLUTE GEARS

By the use of these cutters, heavy cuts at fast speeds and coarse feeds can be taken because of the easier cutting action produced.

The greater part of the cutting is performed by the plain teeth, the stepped teeth projecting beyond the outline of the plain teeth only enough to break up the chips.

Because of the smooth and easy cutting action a minimum amount of power is consumed in driving the machine.

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel			
*1	8 1-2	8 1-2	2	\$57.00	\$85.00
*1 1-4	7 3-4	7 3-4	2	48.00	70.00
*1 1-2	7	7	1 3-4	40.50	55.00
1 3-4	6 1-2	6 1-2	1 3-4	30.35	45.00
2	5 3-4	5 3-4	1 1-2	20.25	35.00
2 1-2	5 1-2	5 3-4	1 1-2	13.90	23.00
3	4 3-8	4 3-4	1 1-4	10.10	18.00
4	3 7-8	4 1-4	1 1-4	7.60	12.00
5	3 5-8	3 3-4	1 1-4	6.35	10.00
6	3	3 1-8	1	5.45	8.00
7	2 7-8	2 7-8	1	5.15	7.00
8	2 7-8	2 7-8	1	5.00	6.00

* Made to order.

For Use on No. 3 Automatic Gear Cutting Machines

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel				
4	3 1-2	3 5-8	1	5-32 x 5-64	\$7.00	\$12.00
5	3 1-4	3 3-8	1	5-32 x 5-64	6.00	10.00
6	3	3 1-8	1	5-32 x 5-64	5.45	8.00
7	2 7-8	2 7-8	1	5-32 x 5-64	5.15	7.00
8	2 7-8	2 7-8	1	5-32 x 5-64	5.00	6.00

Cutters for pitches not given in the above list made to order.
List continued on next page.

For List of Keyways, see page 230.

Improved Stocking Cutters

For Use on Nos. 3 Heavy and 4 Automatic Gear Cutting Machines

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel				
3	4 3-8	4 3-4	1 1-4	3-16 x 3-32	\$10.10	\$18.00
4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	7.60	12.00
5	3 5-8	3 3-4	1 1-4	3-16 x 3-32	6.35	10.00
6	3 1-2	3 1-2	1 1-4	3-16 x 3-32	6.00	8.40
7	3 3-8	3 3-8	1 1-4	3-16 x 3-32	5.85	8.00
8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	5.50	7.30

For Use on No. 5 Automatic Gear Cutting Machines

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel				
2	5 3-4	5 3-4	1 1-2	5-16 x 5-32	\$20.25	\$35.00
2 1-2	5 1-2	5 3-4	1 1-2	5-16 x 5-32	13.90	23.00
3	5	5 1-4	1 1-2	5-16 x 5-32	11.40	19.00
4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	8.25	13.20
5	4	4 1-4	1 1-2	5-16 x 5-32	7.00	11.00
6	3 3-4	3 7-8	1 1-2	5-16 x 5-32	6.70	9.00
7	3 5-8	3 5-8	1 1-2	5-16 x 5-32	6.45	8.25
8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	6.20	7.50

For Use on No. 6 Automatic Gear Cutting Machines

Diametral Pitch	Diameter of Cutter, Inches		Hole, Inches	Keyway, Inches	Carbon Steel Cutters Price each	High-Speed Steel Cutters Price each
	Carbon Steel	High-Speed Steel				
1 3-4	6 1-2	6 1-2	1 3-4	3-8 x 3-16	\$30.35	\$45.00
2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	21.50	42.00
2 1-2	5 7-8	6 1-8	1 3-4	3-8 x 3-16	14.60	26.00
3	5 3-8	5 5-8	1 3-4	3-8 x 3-16	12.05	22.00
4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	8.85	14.40
5	4 3-8	4 3-8	1 3-4	3-8 x 3-16	7.60	12.00
6	4 1-4	4 1-4	1 3-4	3-8 x 3-16	7.30	10.40

Cutters for pitches not given in the above list made to order.

The Sizing and Cutting Of Gear Wheels

Diameter, when applied to gears, is always understood to mean the pitch diameter.

Diametral Pitch is the number of teeth to each inch of the pitch diameter.

EXAMPLE. If a gear has 40 teeth and the pitch diameter is 4 inches, there are 10 teeth to each inch of the pitch diameter and the diametral pitch is 10, or, in other words, the gear is 10 diametral pitch.

Diametral Pitch required, circular pitch given. Divide 3.1416 by the circular pitch.

EXAMPLE. If the circular pitch is 2 inches, divide 3.1416 by 2, and the quotient, 1.5708, is the diametral pitch.

Diametral Pitch required, number of teeth and outside diameter given. Add 2 to the number of teeth and divide by the outside diameter.

EXAMPLE. If the number of teeth is 40, the diameter of the blank is $10\frac{1}{2}$ inches; add 2 to the number of teeth, making 42, and divide by $10\frac{1}{2}$; the quotient, 4, is the diametral pitch.

Circular Pitch is the distance from the centre of one tooth to the centre of the next, measured along the pitch line.

EXAMPLE. If the distance from the centre of one tooth to the centre of next tooth, measured along the pitch circle, is $\frac{1}{2}$ inch, the gear is $\frac{1}{2}$ inch circular pitch.

Circular Pitch required, diametral pitch given. Divide 3.1416 by the diametral pitch.

EXAMPLE. If the diametral pitch is 4, divide 3.1416 by 4, and the quotient, .7854 inch, is the circular pitch.

Number of Teeth required, pitch diameter and diametral pitch given. Multiply the pitch diameter by the diametral pitch.

EXAMPLE. If the diameter of the pitch circle is 10 inches and the diametral pitch is 4, multiply 10 by 4, and the product, 40, will be the number of teeth in the gear.

Number of Teeth required, outside diameter and diametral pitch given. Multiply the outside diameter by the diametral pitch and subtract 2.

EXAMPLE. If the whole diameter is $10\frac{1}{2}$ and the diametral pitch is 4, multiply $10\frac{1}{2}$ by 4, and the product, 42, less 2, or 40, is the number of teeth.

Pitch Diameter required, number of teeth and diametral pitch given. Divide the number of teeth by the diametral pitch.

EXAMPLE. If the number of teeth is 40 and the diametral pitch is 4, divide 40 by 4, and the quotient, 10, is the pitch diameter.

Outside Diameter or size of gear blank required, number of teeth and diametral pitch given. Add 2 to the number of teeth and divide by the diametral pitch.

EXAMPLE. If the number of teeth is 40 and the diametral pitch is 4, add 2 to the 40, making 42, and divide by 4; the quotient, 10 1-2, is the whole diameter of the gear or blank.

Thickness of Tooth at Pitch Line required. Divide the circular pitch by 2, or 1.57 by the diametral pitch.

EXAMPLE. If the circular pitch is 1.047 inches, or the diametral pitch is 3, divide 1.047 by 2, or 1.57 by 3, and the quotient, .523 inch, is the thickness of tooth.

Whole Depth of Tooth required. Divide 2.157 by the diametral pitch.

EXAMPLE. If the diametral pitch of a gear is 6, the whole depth is 2.157 divided by 6, which equals .3595.

Whole Depth of Tooth is about 11-16 or exactly .6866 of the circular pitch.

EXAMPLE. If the circular pitch is 2 inches, the whole depth of tooth is $.6866 \times 2$ inches, or 1 3-8 inches nearly.

Distance between Centres of two gears required. Add the number of teeth together and divide one-half the sum by the diametral pitch.

EXAMPLE. If two gears have 50 and 30 teeth, respectively, and are 5 pitch, add 50 and 30, making 80, divide by 2, and then divide the quotient, 40, by the diametral pitch, 5, and the result, 8 inches, is the centre distance.

Measurement of Gears. We call attention to the following tools that have been developed by us to facilitate measurements in connection with the cutting and sizing of gears.

Vernier Caliper No. 573, for determining accurately the depth of gear teeth. Page 108.

Gear Tooth Verniers Nos. 580 and 581, for accurately measuring the thickness at pitch line or the chordal thickness of gear teeth and the distance from top of tooth to the chord. Page 110.

Depth of Gear Tooth Micrometer No. 249, for scribing a line on gear blanks to indicate accurately the extreme depth to cut the teeth. Page 52.

Depth of Gear Tooth Gauges No. 725. Page 159.

Table No. 1 shows the diametral pitches with the corresponding circular pitches.

Table No. 2 shows the circular pitches with the corresponding diametral pitches.

Table No. 1				Table No. 2			
Diametral Pitch	Circular Pitch, Inches	Diametral Pitch	Circular Pitch, Inches	Circular Pitch, Inches	Diametral Pitch	Circular Pitch, Inches	Diametral Pitch
1 1-4	2.5133	11	.286	2	1.571	3-4	4.189
1 1-2	2.0944	12	.262	1 7-8	1.676	11-16	4.570
1 3-4	1.7952	14	.224	1 3-4	1.795	5-8	5.027
2	1.571	16	.196	1 5-8	1.933	9-16	5.585
2 1-4	1.396	18	.175	1 1-2	2.094	1-2	6.283
2 1-2	1.257	20	.157	1 7-16	2.185	7-16	7.181
2 3-4	1.142	22	.143	1 3-8	2.285	3-8	8.378
3	1.047	24	.131	1 5-16	2.394	5-16	10.053
3 1-2	.898	26	.121	1 1-4	2.513	1-4	12.566
4	.785	28	.112	1 3-16	2.646	3-16	16.755
5	.628	30	.105	1 1-8	2.793	1-8	25.133
6	.524	32	.098	1 1-16	2.957	1-16	50.266
7	.449	36	.087	1	3.142	...	....
8	.393	40	.079	15-16	3.351	...	....
9	.349	43	.065	7-8	3.590	...	....
10	.314	..	...	13-16	3.867	...	....

According to the system adopted by the Brown & Sharpe Mfg. Co., any wheel of one pitch will gear into any other wheel or into a rack of the same pitch. Eight cutters are required for each pitch. These eight cutters are adapted to cut from a pinion of twelve teeth to a rack, and are numbered respectively, 1, 2, 3, etc. The number of teeth and the pitch for which a cutter is adapted are also marked on each.

No. 1 will cut wheels from 135 teeth to a rack.

" 2 " " " " 55 to 134 teeth.

" 3 " " " " 35 " 54 "

" 4 " " " " 26 " 34 "

" 5 " " " " 21 " 25 "

" 6 " " " " 17 " 20 "

" 7 " " " " 14 " 16 "

" 8 " " " " 12 " 13 "

If a cutter is wanted for a wheel of 40 teeth of 8 pitch, then the cutter required would be No. 3 of 8 pitch, inasmuch as a No. 3 cutter will cut all wheels containing from 35 to 54 teeth inclusive, and 40 occurring between those numbers, that is the one desired. It should be borne in mind that eight different cutters are required in order to cut all the wheels of any given pitch. Directions for the use of these cutters will be found upon pages 247 and 248.

As these cutters allow of being ground when dull, it is important that they be kept sharp. By paying particular attention to this, cutting will be greatly facilitated, besides being much better done.

It is desirable in applying gearing of any kind, to avoid having wheels or pinions with a small number of teeth. Pinions of twelve teeth will work very well, but a less number of teeth should not be used.

Few mechanics are familiar with the minutiae of gearing, and the necessity of exact sizing of wheels, as to diameter, is often overlooked. Special care is required also to know that the distance of the centres of two wheels running together is correct relatively to the diameters.

Table

Showing Depth of Space and Thickness of Tooth in Spur Wheels,
When Cut with Our Patent Cutters

Pitch of Cutter	Depth to be Cut in Gear, Inches	Thickness of Tooth at Pitch Line, Inches	Pitch of Cutter	Depth to be Cut in Gear, Inches	Thickness of Tooth at Pitch Line, Inches
1 1-4	1.726	1.257	11	.136	.143
1 1-2	1.438	1.047	12	.130	.131
1 3-4	1.233	.898	14	.154	.112
2	1.079	.785	16	.135	.098
2 1-4	.959	.698	18	.120	.087
2 1-2	.863	.628	20	.108	.079
2 3-4	.784	.571	22	.098	.071
3	.719	.524	24	.090	.065
3 1-2	.616	.449	26	.083	.060
4	.539	.393	28	.077	.056
5	.431	.314	30	.072	.052
6	.360	.262	32	.067	.049
7	.308	.224	36	.060	.044
8	.270	.196	40	.054	.039
9	.240	.175	48	.045	.033
10	.216	.157	..	...	...

Tooth Flanks Undercut

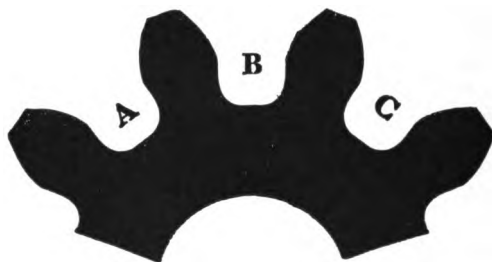


Fig. 1.



Fig. 2.

IT is well known that involute gears can be made of different systems or of different angles of obliquity or pressure. In the system proposed by Professor Willis in 1838, which we adopted in 1864, the angle of pressure, or obliquity, is $14\ 1-2^\circ$. Twice this angle is the familiar angle of the worm-thread tool gauge in common use. Gears made upon this system are thought to crowd less upon their shafts than those having a greater angle of pressure. If, however, a gear or pinion has less than 12 teeth, this angle may cause their flanks to be undercut and in consequence weak, in order to clear the faces of an engaging gear. The cut of a segment of a gear of 10 teeth, 4 diametral pitch, Fig. 1, illustrates this undercutting, which is greater as the teeth are less.

Gears or pinions having less than 12 teeth might be unavailable if undercut as much as at A, B and C in the illustration Fig. 1. Hence, gears that are to do heavy work may require a greater angle of pressure than $14\ 1-2^\circ$, if they are to run with a pinion of less than 12 teeth. If a different angle is required, special cutters will have to be made at an extra cost.

In the choice of an angle of pressure, some help may be obtained from Fig. 2, which is taken from a gear 10 teeth, 4 pitch. The angle of pressure in these teeth is $22\ 1-2^\circ$. The greater strength of the tooth flanks in this figure is readily seen. The angle cannot be much more than 32° and have the addendum of the teeth of the ordinary height, which is equal to the module.

Comparative Sizes of Gear Teeth

INVOLUTE



20 P



18 P



16 P



14 P



12 P



10 P



9 P



8 P



7 P



6 P



5 P



4 P

Comparative Sizes of Gear Teeth

INVOLUTE (*Continued*)



3 P



2½ P



2 P

Hobs

BROWN & SHARPE Hobs, due to our method of relieving the teeth, cut as freely as milling cutters and are sharpened in the same manner as our formed cutters. The selection and treatment of the steel used in their manufacture are subjects of intensive study and careful investigation. Special machinery enables us to produce hobs for hobbing spur, spiral or helical gears, ratchets, sprockets and splined shafts as well as hobs for special purposes at short notice.

Ground Hobs

WHILE unground hobs may fill the needs of ordinary practice, we recommend Ground Hobs for best results where extreme accuracy, uniformity and quiet are required.

Not only will the gears hobbled with Ground Hobs run more quietly, but the hob can be used from one end to the other without attention other than shifting it endwise. This is not always permissible with the unground hob owing to slight errors due to distortion in hardening. These errors may appear at any point in the unground hob, thus limiting its use.

In grinding the teeth of hobs, not only is the lead corrected, but the cutting edges are made keen with a positive clearance from the cutting edge, which eliminates the danger of rubbing on the sides of the teeth.

We make it a point to carefully test each hob on a special Hob Testing Machine after grinding.

All our ground hobs are made with short hubs, which are ground true with the hole and the teeth, and serve as points for indicator when testing hobs for true running after mounting and clamping to the hob spindle.

Worm Wheel Hobs

WITH RELIEVED TEETH



BY our method of relieving hobs, they cut as freely as milling cutters and are sharpened in the same manner as our formed cutters.

We usually make the hobs a sufficient amount larger than the worm to give clearance to the top of the teeth and to allow a reasonable amount for the grinding of the teeth without reducing the diameter of the hob to less than that of the worm.

ORDERING WORM WHEEL HOBS

In ordering Worm Wheel Hobs the following data should be given:

Outside diameter and length of worm.

Lead, i.e., the advance to one turn.

Whether thread is single, double, etc.

Whether thread is right or left hand.

Diameter of hole.

Size of keyway.

Material to be cut.

Whether hob is to be carbon or high-speed steel.

Method of cutting worm; in lathe with tool or in milling machine with cutter; if with cutter, give size of cutter.

Included angle of tool or cutter used to cut worm.

Number of teeth in wheel, whether wheel is driven by hob when hobbing or by hobbing machine spindle.

If nature of work requires hob of exact diameter, it should be plainly stated, otherwise allowance mentioned above will be added.

Hobs continued on next page.

Hobs (*Continued*)



ORDERING SPUR GEAR HOB

In ordering Spur Gear Hobs the following data should be given:

Pitch of gear to be cut.

Diameter and length of hob.

Size of hole and keyway.

Whether single or multiple thread.

Whether hob should be of carbon or high-speed steel.

Special Purpose Hobs



Our equipment of special machinery enables us to meet your requirements in the matter of Special Purpose Hobs quickly and economically. Give complete details and, if possible, send blueprints.

Gears

In addition to the extensive equipment employed for the cutting of hundreds of gears daily for use on our own machinery, we operate a completely equipped Gear Department for serving our many customers. With this equipment we can furnish to your order:

Spurs Gears to 72" diameter.

Planed Bevel Gears to 18" diameter (either the straight, angular or spiral type).

Spiral Gears to 36" diameter.

Worms and Worm Wheels.

Racks, Clutches, etc.

Our experience in the manufacture of gears extends over fifty years, the benefit of the accumulated experience from such an extended period of precision gear cutting being at your command.

Gears for Motor Vehicles

Since the introduction of the Motor Vehicle, we have accumulated much valuable data on the design and results of many practical and projected forms of gears used in their manufacture. This information is entirely at the service of customers.

We have excellent facilities for producing these gears. The best equipment to be found for cutting, hardening, grinding and testing has been installed, enabling us to insure customers prompt delivery of first-quality gears.

The Gear Department is equipped with the very latest machinery for producing Bevel Gears and can furnish them to your specifications of either the straight, angular or spiral type, the two latter types being those so generally adopted for automobile rear axles.

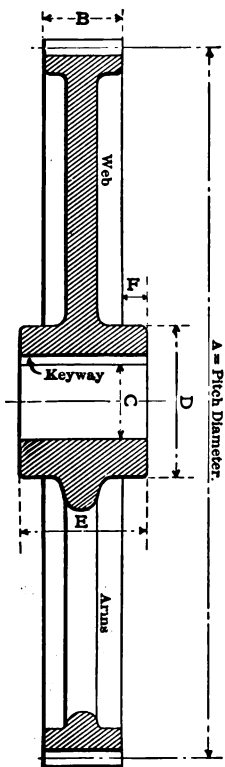
We were among the first to exploit the worm type of drive and have the most improved machinery for cutting Worm Gears and every facility for testing them. We can harden and grind the threads of the worm when required.

Quotations cheerfully given. On asking for quotations please send complete information, blue prints, etc. See next three pages for necessary data in ordering spur and bevel gears.

Instructions for Ordering Spur Gears

Always send drawing when possible

In ordering Spur Gears, the following information should be given:



Pitch, or if preferred, Pitch Diameter, A

Number of Teeth

Width of Face, B

Diameter of Hole in Hub, C

Diameter of Hub, D

Length of Hub, E

Distance from Face of Gear to end of Hub, F

Keyway or Set Screw, and what size

Material to be used

Arms or Web

Number of revolutions per minute at which gears are to run

To be used for pattern, or not

Unless otherwise specified, face and ends of hubs only will be finished and stock will be left on ends of hub for fitting.

The upper half of the cut shows a section through a web gear and the lower, a section through an arm gear.

If the above information is clearly given, it will save much delay in filling orders.

Bevel Gears

THE curve of teeth in bevel gears, when correctly formed, changes constantly from one end of the tooth to the other. Therefore bevel gears, whose teeth are produced with a cutter of fixed curve, are not theoretically correct, the cutter usually being of a curve that will make the correct form at the outer part of the face of the gear, and of necessity will leave the curves too large at the inside ends of the teeth.

Small bevel gearing is almost universally produced in this manner, which practically answers the purpose, except when the teeth are very coarse or the gears very small, in which cases their operation is not satisfactory.

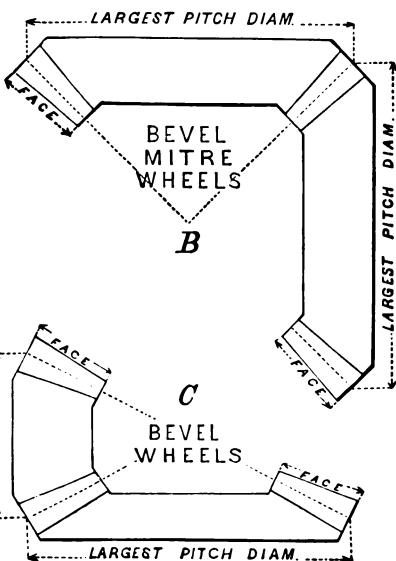
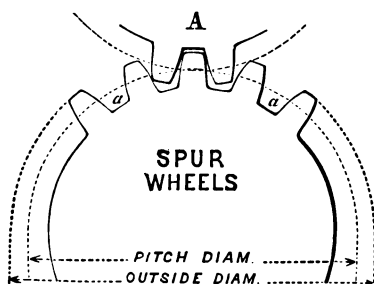
In place of cutting by changing position of cutter, etc., the teeth are often filed slightly, in order to round them off to the curve required for their free running.

On all bevel gears cut with a cutter of fixed curve, it is necessary to cut through twice owing to the necessity of making the thickness of the cutter on the pitch line equal to about .005" thinner than the space between the teeth at the smallest pitch diameter. As the width of space between the teeth on the largest pitch diameter should be greater than the thickness of the cutter, it must be made so by passing the cutter through a second time.

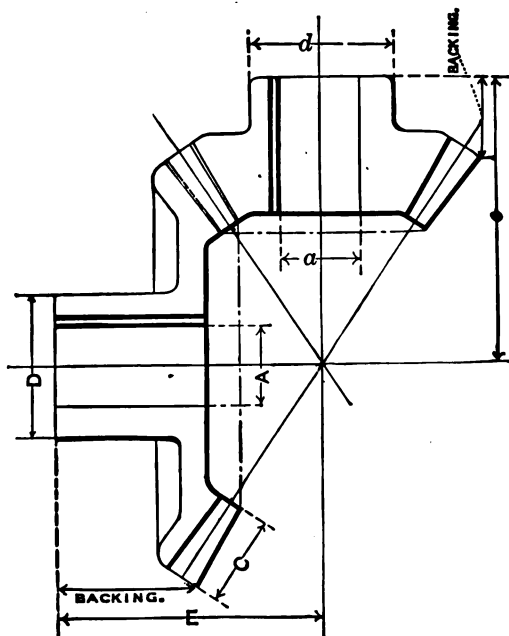
The cuts on this page will explain the forms of spur, bevel and mitre gears, also the terms "pitch diameter," "outside diameter," "largest pitch diameter," "length of face," etc.

When a pair of bevel gears are of same size and number of teeth, with their lines of centres at right angles, they are called "mitre gears," and one cutter will answer for both; but where one gear has a greater number of teeth, or differs in bevel from the one running into it, then each of the pair of gears may require a different cutter.

For directions in ordering cutters for bevel gears, see pages 253-259.



Instructions for Ordering Bevel Gears



When ordering Bevel Gears please give the following information:

Pitch, or if preferred, give diameter of pitch circle.

Number of teeth in gear.

Number of teeth in pinion.

Diameter of Hole in gear, A .

Diameter of Hole in pinion, a .

Backing for both gear and pinion.

Width of face, C .

Diameter of gear hub, D .

Diameter of pinion hub, d , if these dimensions are of importance.

Distance from centre of pinion shaft to end of gear hub, E .

Distance from centre of gear shaft to end of pinion hub, e .

Keyway or set screw, and what size.

Material to be used.

To be used for pattern or not?

Does the pinion drive or is it driven?

Unless otherwise specified, face and ends of hubs only will be finished and stock will be left on ends of hub for fitting.

Formulas

For Determining the Dimensions of Gears by Diametral Pitch

Let P denote the diametral pitch, or the number of teeth to one inch of diameter of pitch circle.

"	D'	"	"	diameter of pitch circle.	}	Larger Wheel	}	These wheels run together
"	D	"	"	whole diameter.				
"	D'''	"	"	bottom diameter.				
"	N	"	"	number of teeth.				
"	V	"	"	velocity.	}	Smaller Wheel		
"	d'	"	"	diameter of circle.				
"	d	"	"	whole diameter.				
"	d'''	"	"	bottom diameter.				
"	n	"	"	number of teeth.	}	Smaller Wheel		
"	v	"	"	velocity.				
"	a	"	"	distance between the centres of the two wheels.				
"	b	"	"	number of teeth in both wheels.				
"	t	"	"	thickness of tooth or cutter on pitch circle.				
"	D''	"	"	working depth of tooth.				
"	f	"	"	amount added to depth of tooth for rounding the corners and for clearance.				
"	D' + f denote the whole depth of tooth.							
"	π denote the constant 3.1416.							
"	P' denote the circular pitch or the distance from the centre of one tooth to the centre of the next on the pitch circle.							

The examples placed opposite the formulas on the two pages following are for a single wheel of 12 pitch, 6.166 in. or 6 2-12 in. diameter, etc., and in the case of the two wheels the larger has the same dimensions. The velocities are respectively 1 and 2.

For a Single Wheel

FORMULAS.

EXAMPLES.

$P = \frac{N + 2}{D} = \frac{72 + 2}{6.166}$, or $\frac{72 + 2}{6 \ 2-12} = 12$	1
$P = \frac{N}{D'} = \frac{72}{6} = 12$	2
$D' = \frac{D \times N}{N + 2} = \frac{6.166 \times 72}{72 + 2} = 6$	3
$D' = \frac{N}{P} = \frac{72}{12} = 6$	4
$N = P D' = 12 \times 6 = 72$	5
$N = P D - 2 = 12 \times 6.166 - 2$, or $12 \times 6 \ 2-12 - 2 = 72$	6
$D = \frac{N + 2}{P} = \frac{72 + 2}{12} = 6.166$, or $6 \ 2-12$	7
$D = D' + \frac{2}{P} = 6 + \frac{2}{12}$, or $6 + .166 = 6.166$	8
$D''' = \frac{N - 2.314}{P} = \frac{72 - 2.314}{12} = 5.807$	9
$D''' = D - 2 (D' + f) = 6.166 - .3596 = 5.807$	10
$t = \frac{1.57}{P} = \frac{1.57}{12} = .130$	11
$D'' = \frac{2}{P} = \frac{2}{12} = .166$, or $2-12$	12
$f = \frac{t}{10} = \frac{.130}{10} = .013$	13
$D'' + f = .166 + .013 = .179$	14
$P' = \frac{\pi}{P} = \frac{3.1416}{12} = .262$	15
$P = \frac{\pi}{P'} = \frac{3.1416}{.262} = 12$	16

For a Pair of Wheels

FORMULAS.**EXAMPLES.**

$$b = 2 a P = 2 \times 4.5 \times 12 = 108. \dots\dots\dots 17$$

$$n = \frac{b V}{v + V} = \frac{108 \times 1}{3} = 36 \dots\dots\dots 18$$

$$N = \frac{n v}{V} = \frac{36 \times 2}{1} = 72 \dots\dots\dots 19$$

$$n = \frac{N V}{v} = \frac{72 \times 1}{2} = 36 \dots\dots\dots 20$$

$$N = \frac{b v}{v + V} = \frac{108 \times 2}{3} = 72. \dots\dots\dots 21$$

$$n = \frac{P D' V}{v} = \frac{12 \times 6 \times 1}{2} = 36 \dots\dots\dots 22$$

$$V = \frac{n v}{N} = \frac{36 \times 2}{72} = 1 \dots\dots\dots 23$$

$$v = \frac{N V}{n} = \frac{72 \times 1}{36} = 2 \dots\dots\dots 24$$

$$v = \frac{P D' V}{n} = \frac{12 \times 6 \times 1}{36} = 2 \dots\dots\dots 25$$

$$D = \frac{2 a (N + 2)}{b} = \frac{2 \times 4.5 \times (72 + 2)}{108} = 6.166 \dots\dots\dots 26$$

$$d = \frac{2 a (n + 2)}{b} = \frac{2 \times 4.5 \times (36 + 2)}{108} = 3.166. \dots\dots\dots 27$$

$$a = \frac{b}{2 P} = \frac{108}{2 \times 12} = 4.5. \dots\dots\dots 28$$

$$D' = \frac{2 a v}{v + V} = \frac{2 \times 4.5 \times 2}{3} = 6 \dots\dots\dots 29$$

$$d' = \frac{2 a V}{v + V} = \frac{2 \times 4.5 \times 1}{3} = 3 \dots\dots\dots 30$$

$$a = \frac{D' + d'}{2} = \frac{6 + 3}{2} = 4.5 \dots\dots\dots 31$$

Milling Machine Cutter Arbors

FOR USE ON BROWN & SHARPE MILLING MACHINES
HAVING TAPER-NOSE SPINDLE



Style F



Style G

No. of Arbor	No. of Taper Shank	Diam. of Arbor, Inches	Length Shoulder to Nut, Inches	Diam. of Hardened Sleeve, Inches	Style	Machines where used	Price
501	10	7-8	12	1 13-16	F	Nos. *1-*1A-2-2A-Univ. M. M.; 1-1B-2-2B-1Y-2Y Pl. M. M.; 21 Auto. M. M.	\$27.50
502	10	1	12	1 13-16	F		27.50
503	10	1 1-4	12	1 13-16	F		27.50
504	10	7-8	17	1 13-16	F		29.00
505	10	1	17	1 13-16	F		29.00
506	10	1 1-4	17	1 13-16	F		29.00
510	11	7-8	16	2 1-16	G		33.00
511	11	1	16	2 1-16	G		33.00
512	11	1 1-4	19 1-2	2 1-16	G		35.00
513	11	1 1-2	19 1-2	2 1-16	G		35.00
514	11	7-8	20	2 1-16	G	Nos. 3-3A Univ. M. M.; Nos. 2B Hy.-3-3B-13B Pl. M. M.	34.00
515	11	1	22	2 1-16	G		36.00
516	11	1 1-4	24	2 1-16	G		37.00
517	11	1 1-2	24	2 1-16	G		37.00
520	12	1	22	2 5-16	G		36.00
521	12	1 1-4	26 3-4	2 5-16	G		38.50
522	12	1 1-2	26 3-4	2 5-16	G		38.50
523	12	1 3-4	26 3-4	2 5-16	G		39.00
530	14	1	25	2 9-16	G		39.00
531	14	1 1-4	29	2 9-16	G		41.00
532	14	1 1-2	29	2 9-16	G	Nos. 4A Hy. Univ. M. M.; Nos. 4B Hy.-5B Hy. Pl. M. M.	41.00
533	14	1 3-4	29	2 9-16	G		42.00
534	14	2	29	2 9-16	G		42.00
535	14	1	30	2 9-16	G		41.00
536	14	1 1-4	35	2 9-16	G		43.00
537	14	1 1-2	35	2 9-16	G		43.00
538	14	1 3-4	35	2 9-16	G		45.00
539	14	2	35	2 9-16	G		45.00

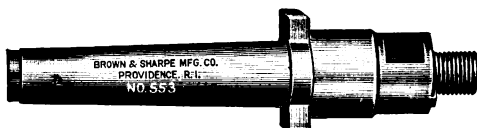
* With or without Back Gears.

Standard Tapers and Taper Holes, page 290.

For list of tools for use on machines having Threaded-Nose Spindles, see pages 295 to 300.

Milling Machine Screw Arbors

FOR USE ON BROWN & SHARPE MILLING MACHINES HAVING
TAPER-NOSE SPINDLE



No. of Arbor	No. of Taper	Diam. of Arbor, Inches	Thread for Cutter	Machines where used	Price
551	10	1	10, L	{ *1-*1A-2-2A Univ. M. M.; *1-*1B-2-2B-1Y-2Y Pl.; 21 Auto. M. M. }	\$12.00
552	10	1	10, R		12.00
553	11	1	10, L	{ 3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2 and 5 Vert. Sp. M. M. }	16.00
554	11	1	10, R		16.00
555	12	1	10, L	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	16.00
556	14	1	10, L	{ 4A Hy. Univ. M. M.; 4B Hy. -5B Hy. Pl. M. M. }	18.00
557	11	1 1-4	8, L	{ 3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2 and 5 Vert. Sp. M. M. }	16.50
558	11	1 1-4	8, R		16.50
559	12	1 1-4	8, L	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	16.50
560	12	1 1-4	8, R		16.50
561	14	1 1-4	8, L	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M. }	18.50
562	14	1 1-4	8, R		18.50
563	11	1 1-2	8, L	{ 3-3A Univ. M. M.; 2B Hy. -3-3B-13B Pl. M. M.; 2 and 5 Vert. Sp. M. M. }	15.50
564	11	1 1-2	8, R		15.50
565	12	1 1-2	8, L	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	16.50
566	12	1 1-2	8, R		16.50
567	14	1 1-2	8, L	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M. }	17.50
568	14	1 1-2	8, R		17.50

* With or without back gears.

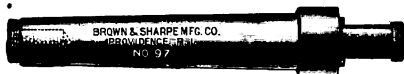
Standard Tapers, page 290.

For List of Tools for Use on Machines having Threaded-Nose Spindles,
see pages 295 to 300.

Arbors for Shell-End Mills



Style A



Style B

No. of Arbor	No. of Taper	Diameter of Arbor, Inches	Diameter Mills Arbor will take, Inches	Style	Price
89	7	1-2	1 1-4 to 1 1-2	A	\$8.00
90	9	3-4	1 9-16 to 2 3-16	A	8.00
91	9	1	2 1-4 to 3	A	8.25
92	9	1-2	1 1-4 to 1 1-2	B	8.00
93	9	1-2	1 1-4 to 1 1-2	A	8.00
94	10	3-4	1 9-16 to 2 3-16	A	9.25
95	10	1	2 1-4 to 3	A	9.75
96	9	3-4	1 9-16 to 2 3-16	B	8.00
105	9	1	2 1-4 to 3	B	8.75
97	10	3-4	1 9-16 to 2 3-16	B	9.25
98	10	1	2 1-4 to 3	B	9.75

Machines Where Used

Arbor No. 89 on No. 1 Vert. Sp. M. Att.; No. 1 Comp. Vert. Sp. M. Att.; No. 1 Univ. M. Att.

Arbors Nos. 90-91-92-93-96-105 on Nos. 00-0-0Y Plain Mill. Machines; No. 2 Vert. Sp. M. Att.; No. 2 Comp. Vert. Sp. M. Att.; Nos. 2-3-4 Univ. M. Att.

Arbors Nos. 97-98 on Nos. *1-*1A-2-2A Univ. M. M.; Nos. *1-*1B-2-2B-1Y-2Y Plain and 21 Auto. M. M.

* With or without Back Gears.

In ordering, state whether Arbor is for Right- or Left-Hand Mill.

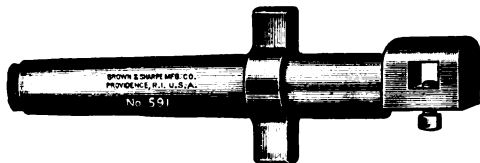
Style A Arbors can be used on larger machines by the use of collets. Collets, page 300.

Morse Taper furnished when desired.

Standard Tapers and Taper Holes, page 290. List of Mills, page 229.

For List of Tools for Use on Machines having Threaded-Nose Spindles, see pages 295 to 300.

Fly Cutter Arbors

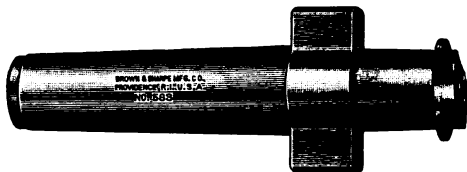


For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle

No. of Arbor	No. of Taper Shank	Machines where used	Square Hole in Head, Inches	Price
590	10	{ *1-*1A-2-2A Univ. M. M.; *1-1B-2-2B Pl. M. M.; 21 Auto. M. M. }	3-4	\$22.00
591	11	{ 3-3A Univ. M. M.; 3-3B Pl. M. M.; 2-5 Vert. Sp. M. M. }	3-4	25.50
592	12	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	3-4	27.50
593	14	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M. }	3-4	29.50

Arbors for Face Milling Cutters

For use on Brown & Sharpe Milling Machines having Taper-Nose Spindle



No. of Arbor	No. Taper Shank	No. Taper for Mill	Machines where used	Price
580	10	14	{ *1-*1A-2-2A Univ. M. M.; *1-*1B-2-2B Pl. M. M.; 21 Auto. M. M. }	\$20.00
581	11	14	{ 3-3A Univ. M. M.; 3-3B Pl. M. M.; 2-5 Vert. Sp. M. M. }	20.00
582	12	14	{ 3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M. }	22.00
583	14	14	{ 4A Hy. Univ. M. M.; 4B Hy.-5B Hy. Pl. M. M. }	24.00

* With or without Back Gears.

Standard Tapers and Taper Holes, page 290.

Screw Slotting Cutter Arbors



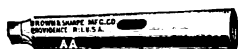
These arbors are for use with Screw Slotting Cutters and are adapted for use on Centres. The following sizes are carried in stock: 3-8", 1-2", 5-8", 3-4", 7-8", 1". Price each, \$3.75. They are also made with No. 7 Taper Shank for use on the Screw Slotting Machine and can be furnished at short notice.

For List of Screw Slotting Cutters, see pages 242 and 243.

For List of Tools for use on machines having Threaded-Nose Spindle, see pages 295 to 300.

Collets

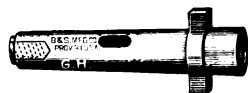
FOR USE ON BROWN & SHARPE MILLING MACHINES
HAVING TAPER-NOSE SPINDLE



Style 1



Style 2



Style 5



*Style 6



Mark	Out- side Taper	Inside Taper	Style	Collet to Spindle, Inches	Machines where used	Price
AA	7	4	1	5-16	1 High-Speed Milling Att. †1-†1A-2-2A Univ. M. M.; †1-†1B-2-2B Pl. M. M.; 2I Auto. M. M.; 1 Vert. Sp. M. M.; 1H Vert. Sp. M. Att.	\$4.25
EF	10	5	2	2 1-8		7.50
BB	10	7	2	1 1-4		8.25
FF	10	9	2	1 1-4		8.25
QQ	11	7	2	1 3-4	3-3A Univ. M. M.; 2B Hy. -3-3B Pl. M. M.; 2-5 Vert. Sp. M. M.; 2H-3-4-5 Vert. Sp. Att.	9.00
O	11	9	2	1-4		10.50
GO	11	9	5	2		14.00
GH	11	9	5	1		14.00
PQ	11	10	5	1 3-4	3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.; 3H Vert. Sp. M. Att. 4A Hy. Univ. M. M.; 4H-5H Vert. Sp. M. M.; 4B Hy. -5B Hy. Pl. M. M.	14.00
SS	12	9	2	7-16		12.50
ST	12	9	5	1 1-4		14.00
OP	12	10	5	1 1-2		14.00
TU	14	9	5	1 1-4	3A Hy.-4A Univ. M. M.; 3B Hy.-4B Pl. M. M.; 3 Vert. Sp. M. M.; 3H Vert. Sp. M. Att. 4A Hy. Univ. M. M.; 4B Hy. -5B Hy. Pl. M. M.; 4H-5H Vert. Sp. M. M.	15.00
*AB	12	11	6	1 3-8		35.00
*CD	14	12	6	1 1-8		45.00

* Will permit arbors D and E for Threaded-Nose Spindle to be used with Taper-Nose Spindle.

† With or without Back Gears.

Standard Tapers and Taper Holes, page 290.

For List of Tools for use on Machines having Threaded-Nose Spindles, see pages 295 to 300.

Collet Blanks



Price includes Turning Plug and Knockout Key.

Diameter, Inches	Length over All, Inches	No. of Taper Hole	Price
3-4	5 1-4	4	\$3.40
1 1-8	8 1-2	5	4.20
1 5-8	10	7	5.00
1 5-8	12	9	7.50
2	14	10	9.00

B & S Standard Taper Holes

To find the number of taper hole in spindle, measure the diameter of large end of hole and the corresponding taper may be found in the following list.

No. of Taper	Approximate Diam. at Large End, Inches	No. of Taper	Approximate Diam. at Large End, Inches
6	19-32	12	1 13-16
7	23-32	14	2 11-32
9	1 1-16	16	2 7-8
10	1 1-4	18	3 7-16
11	1 1-2	..	.....

B & S Standard Tapers

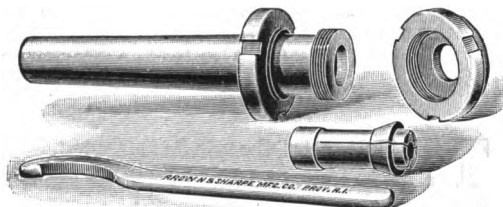
FOR SPINDLES, COLLETS, ARBORS, &c.

No. of Taper	Diam. at Small End, Inches	No. of Taper	Diam. at Small End, Inches	No. of Taper	Diam. at Small End, Inches
1	.200	7	.600	13	1.750
2	.250	8	.750	14	2.000
3	.312	9	.900	15	2.250
4	.350	10	1.0446	16	2.500
5	.450	11	1.250	17	2.750
6	.500	12	1.500	18	3.000

Spring Chucks for Milling Machines

Can be Used on Machines with either Taper- or Threaded-Nose Spindle

This Chuck is found convenient for holding wire, small rods, straight shank drills, mills, etc.



The Collet Holder is of steel, ground to fit a standard taper hole, and has a hole its entire length. The spring collet is held in place by a cap nut that forces it against the taper seat and closes the chuck centrally.

No. of Chuck	No. of Outside Taper	Hole Through, Inches	Machines where used	R'nd Coll. Furn.		Price
				No.	Size, Inches	
150	7	5-16	0 and 1 Vert. Sp. Att. 1 Comp. and 1 Univ. Mill. Att. 00-0-0Y Pl. M. M.	00	1-4	\$16.00
152	9	1-2	6 Univ. Index Centres *1-*1A-2-2A Univ. *1-*1B-1Y-2-2B-2Y Pl.; and 21 Auto. M. M.	00	5-16	16.00
154	10	21-32	1 Vert. Sp. M. M. 10" and 12" Pl. and 10" Univ. Index Centres 2A Hy.-3-3A Univ. M. M.	10	3-8	20.00
156	11	3-4	12" and 14" Univ. Index Cent. 2 Hy.-2B Hy.-3-3B Pl. 2 and 5 Vert. Sp. M. M. 3A Hy.-4A Univ. M. M.	21	5-8	21.00
158	12	1	3B Hy.-4B Pl. M. M. 12 1-2" and 15" Univ. Index Centres; 3 Vert. Sp. M. M.	21	5-8	24.00
160	14	1	4A Hy.-4B Hy.-5B Hy. Pl. M. M.	21	5-8	26.50

Standard Taper Holes, page 290.

* With or without back gears.

Spring Collets for Use with Spring Chucks

No. 00, for Chucks Nos. 150 and 152, Round, 1-16" to 1-2" by 64ths	\$4.00
Square or Hexagonal, made to order	8.00
No. 10, for Chuck No. 154, Round, 1-16", 3-32" to 5-16", by 64ths;	
11-32" to 1-2", by 32nds; 9-16", 5-8"	4.75
Square, 3-16" and 1-4"	8.00
Hexagonal, 3-16", 1-4" and 5-16"	8.00
No. 21, for Chucks Nos. 156, 158 and 160, Round, 1-8" to 21-32", by	
32nds; 11-16" to 1", by 16ths	5.25
Square, 1-4", 5-16", 3-8" and 7-16"	8.25
Hexagonal, 1-4", 5-16", 3-8", 7-16" and 1-2"	8.25
Other sizes made to order	
For List of Tools for use on machines having Threaded-Nose Spindle, see pages 295 to 300.	

The Taper-Nose Spindle

An Exclusive Feature on Brown & Sharpe Milling Machines

THE front end of the spindle is tapered, hardened and ground and has a recess to receive cutter driver or the clutch on arbors and collets. Arbors and collets are provided with clutches and have a threaded hole in the end of the shank. The clutch fits into the recess in the end of the spindle and the arbor or collet is drawn into place and held securely by a drawing-in bolt which passes through the centre of spindle.

Face milling cutters are drawn directly onto the taper-nose of the spindle by a cutter driver and drawing-in bolt, the former fitting a slot in the cutter and the recess in the spindle.

Advantages. The simplicity and fewness of parts are noteworthy. Because there are no plates, screws or loose parts, the nose of the spindle is smooth and entirely free from projections.

A cutter or collet once in place is practically as firm as though part of the spindle, yet can be removed with a minimum of effort. This can be best appreciated in the case of face milling cutters, no time-wasting "freezing" of cutters to spindle being possible.

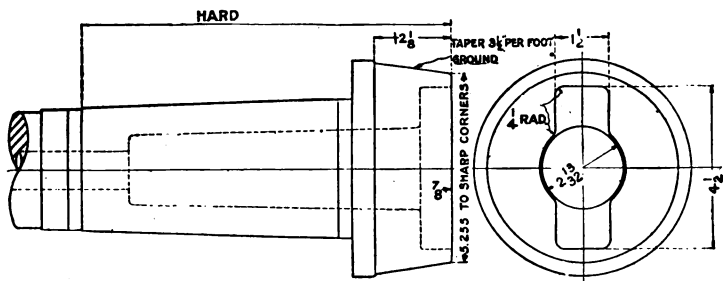
The taper-nose spindle gives a steady, positive drive under the heaviest cut.

Adapter Outfit

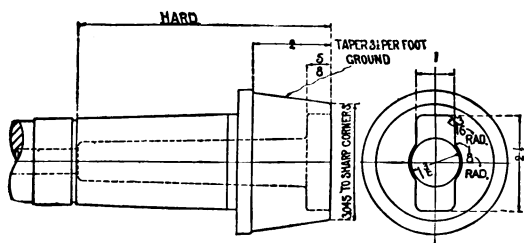
USERS of Milling Machines with the old type spindle and cutters can change the cutters to permit their use on taper-nose as well as on threaded-nose spindles. This is accomplished as shown on page 294. Then by the use of the Adapter Outfit shown on same page, the cutter can still be used with threaded-nose spindles. Similarly cutters designed for use on the taper-nose can be used, without change, on the threaded-nose spindle when the adapter is used. Price on application.

Information as to size and serial number of machine should accompany inquiries.

Dimensions of the New Taper-Nose Spindle on Brown & Sharpe Milling Machines



Machine	No. of Taper Hole
No. 3, 3A Universal Milling Machines	11 B & S
No. 2B Heavy, 3, 3B, 13B Plain Milling Machines	
No. 2, 5 Vertical Spindle Milling Machines	
No. 3A Heavy, 4A Universal Milling Machines	12 B & S
No. 3B Heavy, 4B Plain Milling Machines	
No. 3 Vertical Spindle Milling Machine	
No. 4A Heavy Universal Milling Machine	14 B & S
No. 4B Heavy, 5B Heavy Plain Milling Machines	

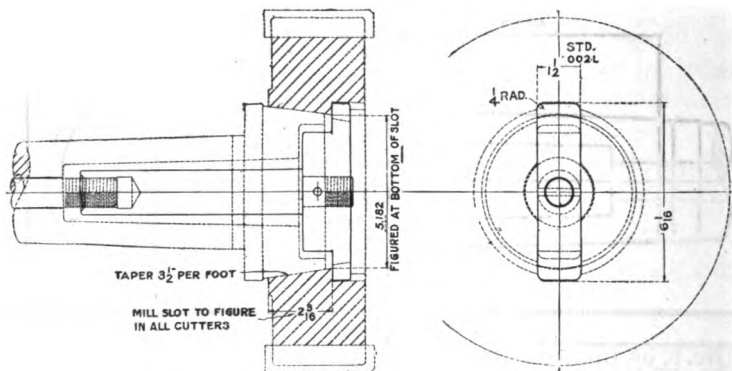


Machine	No. 10 Taper Hole
No. 1, 1A (with or without Back Gears), 2 & 2A Univ. M. M.	No. 10 Taper Hole
No. 1, 1B (with or without Back Gears), 2 & 2B Pl. M. M.	
No. 1Y, 2Y Plain Rack Feed Milling Machines	

Dimensions of Tapped Hole in Shanks of Arbors and Collets

No. 10 Taper 1-2", 14, L. H. Nos. 11 and 12 Taper 3-4", 12, L. H.
No. 14 Taper 1", 10, L. H.

How to Use Inserted-Tooth Cutters Designed for Threaded-Nose Spindle on New Taper-Nose Spindle



Cutters Nos. 53, 54, 56, 57, 59. First cut slot for driver to figure, then rebores as shown.

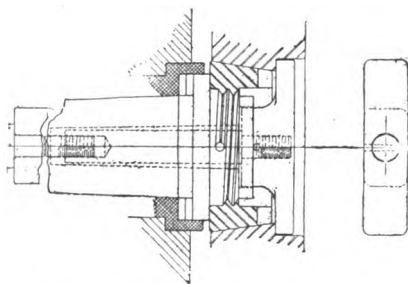
Cutters Nos. 55, 58, 60, 61 need slot for driver only.

Cutters Nos. 50, 51, 52 are too small to use.

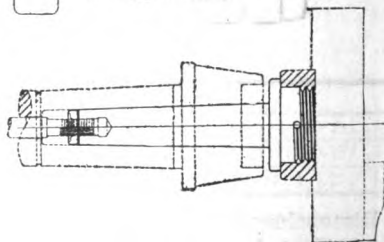
Adapter Outfit

Permits cutters to be used on threaded-nose spindle. It consists of taper sleeve with threaded-hole driver and drawing-in bolt.

When ordering give size and serial number of machine. Price on application.



This diagram illustrates the method of attaching chuck to all milling machines having taper-nose spindle. The thread on collet is the same as on spiral head spindle.



This collet forms part of the equipment of all Universal Milling Machines.

**TOOLS FOR USE ON B & S MILLING MACHINES HAVING
THREADED-NOSE SPINDLE**

Milling Machine Cutter Arbors



Style A



Style B



Style C



Style D



Style E

No. of Arbor	No. of Taper Shank	Diameter of Arbor, Inches	Length Shoulder to Nut, Inches	Diameter of Hardened Sleeve, Inches	Style	Price
04	7	1-2	1	....	A	\$6.75
05	7	1-2	3	....	A	7.25
07	9	5-8	4	....	A	8.00
08	9	7-8	5 1-4	....	A	8.75
09	9	1	5 1-4	....	A	8.75
010	9	5-8	8	....	A	11.75
011	9	7-8	8	....	A	11.75
012	9	1	8	....	A	11.75
1	10	5-8	4	....	A	8.75
6	10	7-8	5 1-4	....	A	11.00
7	10	1	5 1-4	....	A	11.00
9	10	1 1-4	5 1-4	....	A	11.00
10	10	7-8	8	....	A	13.50
11	10	1	8	....	A	13.50
13	10	1 1-4	8	....	A	13.50
40	10	7-8	12	1 13-16	B	21.00
41	10	1	12	1 13-16	B	21.00
43	10	1 1-4	12	1 13-16	B	21.00
44	10	7-8	17	1 13-16	B	22.00
45	10	1	17	1 13-16	B	22.00
47	10	1 1-4	17	1 13-16	B	22.00
53	10	1	14 1-2	1 13-16	D	22.50
55	10	1 1-4	14 1-2	1 13-16	D	22.50
15	11	7-8	10 1-4	....	A	16.00
16	11	1	10 1-4	....	A	16.00
18	11	1 1-4	10 1-4	....	A	16.00
48	11	7-8	16 1-4	2 1-16	B	24.00
49	11	1	17 3-4	2 1-16	B	24.00
51	11	1 1-4	20 1-4	2 1-16	B	26.50
52	11	1 1-2	20 1-4	2 1-16	B	26.50
48-A	11	7-8	16 1-4	2 1-16	C	27.50

Arbors for Taper-Nose Spindles, page 285. Standard Taper Holes, page 290.

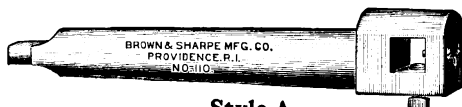
List continued on next page.

Milling Machine Cutter Arbors

(Continued)

No. of Arbors	No. of Taper, Shank	Diameter of Arbor, Inches	Length Shoulder to Nut, Inches	Diameter of Hardened Sleeve, Inches	Style	Price
49-A	11	1	17 3-4	2 1-16	C	\$27.50
51-A	11	1 1-4	20 1-4	2 1-16	C	30.00
52-A	11	1 1-2	20 1-4	2 1-16	C	30.00
35-A	11	7-8	16	2 1-16	E	30.00
36-A	11	1	16	2 1-16	E	30.00
38-A	11	1 1-4	19 1-2	2 1-16	E	31.50
39-A	11	1 1-2	19 1-2	2 1-16	E	31.50
19-A	11	7-8	20	2 1-16	E	31.50
20-A	11	1	22	2 1-16	E	33.50
22-A	11	1 1-4	24	2 1-16	E	35.50
23-A	11	1 1-2	24	2 1-16	E	35.50
65-A	11	1	22	2 5-16	E	33.50
66-A	11	1 1-4	26 3-4	2 5-16	E	36.00
67-A	11	1 1-2	26 3-4	2 5-16	E	36.00
68-A	11	1 3-4	26 3-4	2 5-16	E	36.00
69-A	12	1	25	2 9-16	E	36.00
70-A	12	1 1-4	29	2 9-16	E	36.00
71-A	12	1 1-2	29	2 9-16	E	36.00
71 1-2-A	12	1 3-4	29	2 9-16	E	36.00
72-A	12	2	29	2 9-16	E	36.00
75-A	12	1	30	2 9-16	E	37.00
76-A	12	1 1-4	35	2 9-16	E	38.50
77-A	12	1 1-2	35	2 9-16	E	38.50
78-A	12	1 3-4	35	2 9-16	E	38.50
79-A	12	2	35	2 9-16	E	38.50

Fly Cutter Arbors



Style A

The hole in the head is 3-4" square.

No. of Arbor	Style	No. of Taper	Price
110	A	10	\$11.75
112	A	11	14.75
113	A	12	16.00

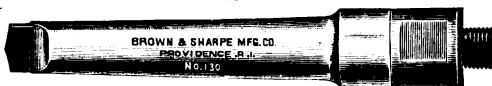
Price includes tool with 1-8" radius. Standard Tapers, page 290.

TOOLS FOR USE ON B & S MILLING MACHINES HAVING
THREADED-NOSE SPINDLE

Milling Machine Screw Arbors and Arbors for Coarse-Tooth Shell End Mills



Style A



Style B



Style C

Style D. — Similar to Style C, but has threaded hole in end for drawing-in bolt.

In ordering, state whether Right- or Left-Hand Arbors are wanted.

No. of Arbor	No. of Taper	Diam. of Arbor, Inches	Thread	Style	Price
120	7	3-8	20, L	A	\$3.75
122	9	1-2	16, L	A	5.00
128	10	1	10, L	B	9.75
†129	10	1	10, R	B	9.75
130	11	1	10, L	B	11.00
*131	10	1	10, L	D	9.75
*†132	10	1	10, R	D	9.75
133	11	1	10, L	C	12.75
†134	11	1	10, R	C	12.75
135	12	1	10, L	C	16.00
138	11	1	10, L	D	12.75
†139	11	1	10, R	D	12.75
142	11	1 1-4	8, L	C	14.00
†143	11	1 1-4	8, R	C	14.00
146	11	1 1-4	8, L	D	14.00
†147	11	1 1-4	8, R	D	14.00
150	12	1 1-4	8, L	C	16.00
†151	12	1 1-4	8, R	C	16.00
154	12	1 1-4	8, L	D	16.00
†155	12	1 1-4	8, R	D	16.00
158	11	1 1-2	8, L	C	14.00
†159	11	1 1-2	8, R	C	14.00
162	11	1 1-2	8, L	D	14.00

* Does not have clutch drive.

† These Arbors are not carried in stock, but can be furnished at short notice.

Standard Tapers and Taper Holes, page 290.

List continued on next page.

**TOOLS FOR USE ON B & S MILLING MACHINES HAVING
THREADED-NOSE SPINDLE**

Milling Machine Screw Arbors and Arbors for Coarse-Tooth Shell End Mills (*Continued*)

No. of Arbor	No. of Taper	Diam. of Arbor, Inches	Thread	Style	Price
*163	11	1 1-2	8, R	D	\$14.00
166	12	1 1-2	8, L	C	16.00
*167	12	1 1-2	8, R	C	16.00
170	12	1 1-2	8, L	D	16.00
*171	12	1 1-2	8, R	D	16.00

* These Arbors are not carried in stock, but can be furnished at short notice.

Arbors for Shell End Mills See page 287

Spring Chucks

See page 291

Spring Collets

See page 291

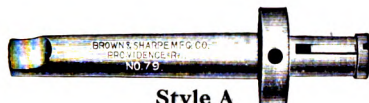
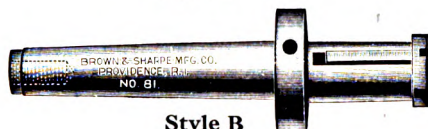
Index Plates

FOR USE ON UNIVERSAL MILLING MACHINES

No.	Machine where used	Diameter of Plate, Inches	Hole in Centre, Inches	Number of Holes in Each Circle	Price
1	{ No. 1 Without Back Gears Prior to 1900 }	4 3-4	1 1-8	15 16 17 18 19 20	\$5.00
2		4 3-4	1 1-8	21 23 27 29 31 33	5.00
3		4 3-4	1 1-8	37 39 41 43 47 49	5.00
7	{ Nos. 1, 1A, Without Back Gears 1, 1A, With Back Gears 2 and 2A }	5	1 1-8	15 16 17 18 19 20	5.00
8		5	1 1-8	21 23 27 29 31 33	5.00
9		5	1 1-8	37 39 41 43 47 49	5.00
13	{ 2A Heavy 3 and 3A }	6 1-4	1 1-2	15 16 17 18 19 20	6.75
14		6 1-4	1 1-2	21 23 27 29 31 33	6.75
15		6 1-4	1 1-2	37 39 41 43 47 49	6.75
20	{ No. 4 Prior to 1893 }	6 15-16	1 1-2	15 16 17 18 19 20	6.75
21		6 15-16	1 1-2	21 23 27 29 31 33	6.75
22		6 15-16	1 1-2	37 39 41 43 47 49	6.75
28	{ 3A Heavy 4A and 4A Heavy }	7 1-2	1 3-4	15 16 17 18 19 20	6.75
29		7 1-2	1 3-4	21 23 27 29 31 33	6.75
30		7 1-2	1 3-4	37 39 41 43 47 49	6.75

Standard Tapers, page 290. For List of Shell End Mills, see page 229.

**TOOLS FOR USE ON B & S MILLING MACHINES HAVING
THREADED-NOSE SPINDLE**

**Style A****Style B****Style C**

Style D. Similar to Style C, but no threaded hole

Arbors for Face Milling Cutters

**WITH INSERTED
TEETH**

No. of Arbor	No. of Taper of Shank	No. of Taper for Mill	Style	Price
79	10	10	A	\$14.00
82	11	12	A	18.00
81	11	12	B	18.00
80	11	10	C	21.50
83	11	12	C	21.50
87	12	12	C	21.50
84	11	12	D	21.50
85	12	12	D	21.50
86	12	10	C	21.50

Screw Slotting Cutter Arbors

Page 288

Collet Blanks

Page 290

Standard Tapers and Taper Holes, page 290.

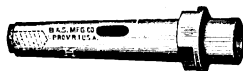
**TOOLS FOR USE ON B & S MILLING MACHINES HAVING
THREADED-NOSE SPINDLE**

Collets



Style 1

Style 2



Style 3

Style 1A. Similar to Style 1, but designed for shanks without tenons.

Style 2A. Similar to Style 2, but no threaded hole.

Style 3A. Similar to Style 3, but no threaded hole.

Mark	Outside Taper	Inside Taper	Style	Collet to Spindle, Inches	Diameter of Threaded Hole, Inches	Price
A	7	4	1A	1 9-16		\$4.25
J	7	4	2	5-16	3-8, 16, L. H.	4.25
N	7	5	1A	2 5-16		4.25
R	7	5	2	3-4	3-8, 16, L. H.	4.25
C	9	5	1A	2 1-8		5.75
D	9	5	1A	3-4		5.25
K	9	5	2	3-8	7-16, 14, L. H.	5.25
KK	9	7	1	3-4		6.75
RR	9	7	2	7-8	7-16, 14, L. H.	6.75
EE	10	5	1A	2 1-8		7.50
DD	10	7	1	2 5-8		7.50
E	10	7	1	1 5-8		7.50
BB	10	7	2	1 1-4	1-2, 14, L. H.	8.25
Z	10	7	2A	1-2		7.50
F	10	9	1	1		8.25
FF	10	9	2	1 1-4	1-2, 14, L. H.	8.25
Q	11	7	1	1 3-4		9.00
G	11	9	1	2 3-8		9.75
O	11	9	2	1-4	3-4, 12, L. H.	10.50
H	11	9	3	1 5-8	3-4, 12, L. H.	12.50
GG	11	10	3A	1-2		12.50
SS	12	9	2	7-16	3-4, 12, L. H.	12.50
T	12	9	3A	1 11-16		13.00
V	12	10	2	7-8	3-4, 12, R. H.	13.00
P	11	10	1	1 3-8		13.00
PP	12	10	3A	1 11-16		13.00
VV	12	11	2	1 7-8	3-4, 12, R. H.	13.00
TT	12	11	3A	1 11-16		13.00
UU	12	9	3	1 11-16	3-4, 12, L. H.	13.00
WW	14	10	2	7-8	3-4, 12, R. H.	15.75
W	14	11	2	7-8	3-4, 12, R. H.	15.75
WV	14	12	2	7-8	3-4, 12, R. H.	15.75
XX	16	11	2	7-8	7-8, 10, R. H.	20.00
X	16	12	2	7-8	7-8, 10, R. H.	20.00
YY	18	11	2	7-8	1, 10, R. H.	23.00
Y	18	14	2	7-8	1, 10, R. H.	25.50

Collets for Taper-Nose Spindles, page 289.
Standard Tapers and Taper Holes, page 290.

Plain Hollow Mills



Style 2



Style 3

The Plain Hollow Mills are designed for use in the turrets of screw machines for roughing cuts.

They are made with two forms of teeth, one undercut, as shown in above illustrations, for milling steel, and one straight, for milling brass.

These mills turn large as follows: up to and including 7-32", approximately .007"; 1-4" to 11-16" inclusive, approximately .011".

No. of Mill	Style	No. of Machine where used	Sizes Carried in Stock, Inches	Diameter of Shank, Inches	Length of Shank, Inches	Diameter of Head, Inches	Length of Head, Inches	Total Length, Inches	Carbon Steel Mills, Price Each	High-Speed Steel Mills, Price Each
†00C	2	00, 00G & 19 Auto	1-16 to 7-32 by 64ths	No. 5 Taper	...	1-2	...	1 1-8	\$1.70	\$2.40
*00D	2	19 Auto	1-8 to 5-16 by 64ths	5-8	7-8	3-4	7-8	1 3-4	1.70	...
20A	3	0 & 0G Au.	1-8 to 3-8 by 32nds	5-8	7-8	3-4	7-8	1 3-4	2.40	3.45
*20B	3	0 & 0G Au.	1-8 to 3-8 by 32nds	3-4	...	3-4	...	2	2.80	3.75
21A	2	1 Auto.	1-4 to 7-16 by 32nds	1	...	1	...	2 1-4	2.80	3.75
22A	2	2 & 2G Au.	15-32 to 11-16 by 32nds	1	1 3-16	1 1-4	1 1-16	2 1-4	3.45	4.50
22C	3	2 & 2G Au.								

* For Brass.

† Made in both Right- and Left-Hand Styles. Unless otherwise specified Right-Hand Mills will be furnished.

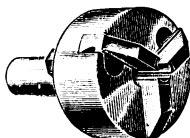
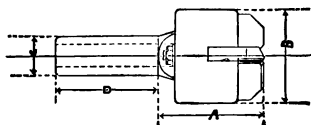
Hollow Mill Blanks

The shanks of the blanks are finished and drilled. State style wanted when ordering.

Style	No. of Machine where used	Carbon Steel Price each	High-Speed Steel Price each
2	00, 00G and 19 Automatic	\$0.45	\$0.70
3	0 and 0G Automatic	.50	1.00
2	1 Automatic	.75	....
2	2 and 2G Automatic	.75	2.00
3	2 and 2G Automatic	.75	2.40

Adjustable Hollow Mills

WITH INSERTED BLADES



Roughing

Each holder is furnished with one set of blades (3) of any regular size required. Blades turn large as follows: 1-4" to 7-16", about .012"; 1-2" to 3-4", about .016"; 13-16" to 1 1-8", about .02". Blades for Nos. 3, 4 and 5 interchange.

The stock sizes of blades run by 16ths of an inch between the limits given under "Capacity," except on Nos. 00 and 0 Mills.

Set of blades turns one size only, except where noted.

When ordering, specify turning size of blades wanted.

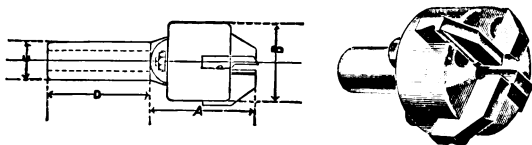
No. of Mill	Number of Machine where used	Capacity, Inches	A Length of Body and Blades, Inches	B Diameter Outside, Inches	C Diameter of Shank, Inches	D Length of Shank, Inches	Price with one Set of Carbon Steel Blades	Price with one Set of High-Speed Steel Blades	Price of extra Carbon Steel Blades, per Set	Price of extra High-Speed Steel Blades, per Set
00	00G & 19 Auto.	.03 to 3-8	1 3-16	1 1-2	5-8	1 1-8	\$11.00	\$12.00	\$2.25	\$3.25
0	0 Wire Feed	.03 to 3-8	1 1-4	1 3-4	5-8	1 7-16	18.00	19.00	3.50	4.50
1	1 Pl. beginning 230* 1 Wire Feed	3-16 to 1-2	2 1-2	2 1-4	3-4	2	20.50	22.00	6.00	7.50
3	2 Pl. beginning 455* 2 and 2F Wire Feed	1-4 to 3-4	3 1-4	3	1	2 1-2	22.00	24.00	7.00	9.00
4	4 Pl. prior to 428* 5 Pl. prior to 428*	1-4 to 3-4	3 1-4	3	1 1-16	3 1-4	22.00	24.00	7.00	9.00
5	6 Pl. prior to 59* 4 Pl. 428 to 601*	1-4 to 3-4	3 1-4	3	1 1-4	3 1-4	22.00	24.00	7.00	9.00
6	4 W. F. prior to 23* 5 Pl. 428 to 581* 6 Pl. 59 to 230*	1-2 to 1 1-8	3 3-8	3 1-2	1 1-2	3 1-4	25.00	27.00	8.00	10.00
24	4 & 5 Pl.; 4 W. F.	1-2 to 1 3-16	3 3-8	3 1-2	1 3-4	3 1-4	27.00	29.00	8.00	10.00
26	6 Pl. & 6 W. F.	1-2 to 1 3-8	3 3-8	3 3-4	2	3 1-4	29.00	31.00	8.00	10.00

* Be sure to give serial number of machine.

† One set of blades turns all sizes within capacity.

Adjustable Hollow Mills

WITH INSERTED BLADES



Finishing

The Finishing Mills have 2 blades and 2 back rests which will turn any size within the capacity of the mill.

Two extra blades are included in "Price of Mill Complete." As the blades wear much faster than the back rests, it is more economical to use blades opposite back rests.

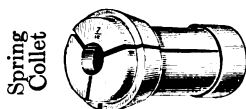
Blades for Nos. 13, 14 and 15 interchange.

No. of Mill	Number of Machine where used	Capacity, Inches	A Length of Body and Blades, Inches	B Diameter Outside, Inches	C Diameter of Shank, Inches	D Length of Shank, Inches	Price of Mill Complete with Carbon Steel Blades	Price of Mill Complete with High-Speed Steel Blades	Price of 4 Carbon Steel Blades	Price of 4 High-Speed Steel Blades	Price of 2 Back Rests
100	00, 00G & 19 Auto.	.03 to 3-8	1 3-16	1 1-2	5-8	1 1-8	\$13.25	\$14.50	\$2.50	\$3.75	\$1.25
10	0 Wire Feed	.03 to 3-8	1 1-4	1 3-4	5-8	1 7-16	21.75	23.75	4.75	6.75	1.50
11	1 Pl. beginning 230* 1 Wire Feed	3-16 to 1-2	2 1-2	2 1-4	3-4	2	24.00	26.25	5.75	8.00	1.75
13	2 Pl. beginning 455* 2 and 2F Wire Feed	1-4 to 3-4	3 1-4	3	1	2 1-2	25.50	28.75	6.75	10.00	2.00
14	4 Pl. prior to 428* 5 Pl. prior to 428*	1-4 to 3-4	3 1-4	3	1 1-16	3 1-4	25.50	28.75	6.75	10.00	2.00
15	6 Pl. prior to 59* 4 Pl. 428 to 601* 4 W. F. prior to 23*	1-4 to 3-4	3 1-4	3	1 1-4	3 1-4	25.50	28.75	6.75	10.00	2.00
16	5 Pl. 428 to 581* 6 Pl. 59 to 230*	1-2 to 1 1-8	3 3-8	3 1-2	1 1-2	3 1-4	29.50	33.50	7.00	11.00	2.10
34	4 & 5 Pl.; 4 W. F.	1-2 to 1 1-4	3 3-8	3 1-2	1 3-4	3 1-4	31.00	35.00	7.00	11.00	2.10
36	6 Pl. & 6 W. F.	1-2 to 1 3-8	3 3-8	3 3-4	2	3 1-4	33.00	37.00	7.00	11.00	2.10

* Be sure to give serial number of machine.

Spring Collets and Feeding Fingers

FOR AUTOMATIC AND WIRE FEED SCREW MACHINES



Spring Collet



Feeding Finger

Nos. 00, 00G and 19 Automatic

		Price each
No. 00 Spring Collets		
English, Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16"		\$4.00
Square: 3-32", 1-8", 5-32", 3-16", 7-32"		8.00
Hexagonal: 1-8", 5-32", 3-16", 7-32", 1-4"		8.00
Metric, Round: 2 m/m to 8 m/m, varying by half m/m		4.00
Collet Blanks		2.35
No. 00 Feeding Fingers		
English, Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16"		2.25
Square: 3-32", 1-8", 5-32", 3-16", 7-32"		4.00
Hexagonal: 1-8", 5-32", 3-16", 7-32", 1-4"		4.00
Metric, Round: 2 m/m to 8 m/m, varying by half m/m		2.25
Feeding Finger Blanks		1.10
No. 00 Spring Collets, for use with 3-8" Feed Tube		
English, Round: 21-64", 11-32", 3-8"		4.00
Square: 1-4"		8.00
Hexagonal: 9-32", 5-16"		8.00
Metric, Round: 8 1-2, 9, 9 1-2 m/m		4.00
Collet Blanks		2.35
*No. 00A Feeding Fingers, for 3-8" Feed Tube		
English, Round: 21-64", 11-32", 3-8"		2.25
Square: 1-4"		4.00
Hexagonal: 9-32", 5-16"		4.00
Metric, Round: 8 1-2, 9, 9 1-2 m/m		2.25
Feeding Finger Blanks		1.10

Nos. 0 and 0G Automatic, also

No. 1 Wire Feed (Prior to Machine Serial No. 227)

No. 11 Spring Collets		
English, Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 21-64", 11-32", 23-64", 3-8", 25-64", 13-32", 27-64", 7-16", 29-64", 15-32", 1-2"		\$4.75
Square: 3-16", 1-4", 5-16", 3-8"		8.00
Hexagonal: 3-16", 1-4", 5-16", 3-8", 7-16"		8.00
Metric, Round: 6 m/m to 12 m/m, varying by half m/m		4.75
Collet Blanks		2.65

* Two feed tubes are furnished with No. 19 Automatic, one taking No. 00 Feeding Fingers and the other No. 00A Feeding Fingers. 3-8" Feed Tube for Nos. 00 and 00G Automatics is furnished as an extra.

List continued on next page.

Other sizes made to order.

Spring Collets and Feeding Fingers (Continued)

No. 11 Feeding Fingers

	Price each
English, Round: 1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 21-64", 11-32", 23-64", 3-8", 25-64", 13-32", 27-64", 7-16", 29-64", 15-32", 1-2"	\$3.00
Square: 3-16", 1-4", 5-16", 3-8"	4.25
Hexagonal: 3-16", 1-4", 5-16", 3-8", 7-16"	4.25
Metric, Round: 6 m/m to 12 m/m, varying by half m/m	3.00
Feeding Finger Blanks	1.45

Nos. 0 and 0G Automatic

No. 11 Spring Collets, for use with 5-8" Feed Tube

English, Round: 17-32", 9-16", 19-32", 5-8"	\$4.75
Hexagonal: 1-2"	8.00
Metric, Round: 12 1-2 m/m to 16 m/m, varying by half m/m	4.75
Collet Blanks	2.65

No. 11A Feeding Fingers, for 5-8" Feed Tube

English, Round: 17-32", 9-16", 19-32", 5-8"	3.00
Hexagonal: 1-2"	4.25
Metric, Round: 12 1-2 m/m to 16 m/m, varying by half m/m	3.00
Feeding Finger Blanks	1.45

No. 11 Spring Collets for use with Outside Feeding Attachment

English, Round: 9-16", 5-8", 11-16", 3-4", 13-16"	4.75
Hexagonal: 1-2", 9-16", 5-8", 11-16"	8.00
Metric, Round: 14 m/m to 20 m/m, varying by 1 m/m	4.75
Collet Blanks	2.65

No. 11B Feeding Fingers, for use with Outside Feeding Attachment

English, Round: 9-16", 5-8", 11-16", 3-4", 13-16"	8.00
Hexagonal: 1-2", 9-16", 5-8", 11-16"	12.00
Metric, Round: 14 m/m to 20 m/m, varying by 1 m/m	8.00
Feeding Finger Blanks	4.00

No. 0 Wire Feed

No. 10 Spring Collets

English, Round: 1-16", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 11-32", 3-8"	\$4.75
Square: 3-16", 1-4"	8.00
Hexagonal: 3-16", 1-4", 5-16"	8.00
Metric, Round: 4 m/m to 10 m/m, varying by half m/m	4.75
Collet Blanks	2.65

No. 10 Feeding Fingers

English, Round: 1-16", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 11-32", 3-8"	3.00
Square: 3-16", 1-4"	4.25
Hexagonal: 3-16", 1-4", 5-16"	4.25
Metric, Round: 4 m/m to 10 m/m, varying by half m/m	3.00
Feeding Finger Blanks	1.45

No. 10 Spring Collets for use with 1-2" Feed Tube

English, Round: 13-32", 7-16", 15-32", 1-2"	4.75
Hexagonal: 3-8", 7-16"	8.00
Collet Blanks	2.65

List continued on next page.

Other sizes made to order.

Spring Collets and Feeding Fingers (*Continued*)

Price each

No. 11C Feeding Fingers for use with 1-2" Feed Tube

English, Round: 13-32", 7-16", 15-32", 1-2"	\$3.00
Hexagonal: 3-8", 7-16"	4.25
Feeding Finger Blanks	1.45

No. 1 Automatic, also

No. 1 Wire Feed (Commencing Machine Serial No. 227)

No. 21 Spring Collets

English, Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8"	\$5.25
Square: 1-4", 5-16", 3-8", 7-16"	8.25
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2"	8.25
Metric, Round: 6 m/m to 16 m/m, varying by half m/m	5.25
Collet Blanks	3.00

No. 21 Feeding Fingers

English, Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8"	3.00
Square: 1-4", 5-16", 3-8", 7-16"	4.25
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2"	4.25
Metric, Round: 6 m/m to 16 m/m, varying by half m/m	3.00
Feeding Finger Blanks	1.45

No. 21 Spring Collets for use with 3-4" Feed Tube

English, Round: 21-32", 11-16", 23-32", 3-4"	5.25
Hexagonal: 9-16", 5-8"	8.25
Collet Blanks	3.00

*No. 21A Feeding Fingers for use with 3-4" Feed Tube

English, Round: 21-32", 11-16", 23-32", 3-4"	3.00
Hexagonal: 9-16", 5-8"	4.25
Feeding Finger Blanks	1.45

No. 2 Wire Feed (Prior to Machine Serial No. 383)

No. 12 Spring Collets

English, Round: 3-16", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 11-16", 3-4", 13-16", 7-8"	\$6.25
Square: 3-8", 7-16", 1-2", 9-16"	8.75
Hexagonal: 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4"	8.75
Metric, Round: 10 m/m to 20 m/m, varying by half m/m	6.25
Collet Blanks	3.00

No. 12 Feeding Fingers

English, Round: 3-16", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 11-16", 3-4", 13-16", 7-8"	3.75
Square: 3-8", 7-16", 1-2", 9-16"	4.75
Hexagonal: 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4"	4.75
Metric, Round: 10 m/m to 20 m/m, varying by half m/m	3.75
Feeding Finger Blanks	1.80

* Used only on No. 1 Wire Feed beginning with Serial No. 495.

List continued on next page.

Other sizes made to order.

Spring Collets and Feeding Fingers (Continued)**No. 2 and 2-G Automatic, also****No. 2 and 2F Wire Feed (Commencing Machine Serial No. 383)**

No. 22 Spring Collets		Price each
English, Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 21-32", 11-16", 23-32", 3-4", 25-32", 13-16", 27-32", 7-8", 29-32", 15-16", 31-32", 1"		\$6.25
Square: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16"		8.75
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4", 13-16", 7-8"		8.75
Metric, Round: 10 m/m to 25 m/m, varying by 1 m/m		6.25
Collet Blanks		3.00

No. 22 Feeding Fingers

English, Round: 1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 21-32", 11-16", 23-32", 3-4", 25-32", 13-16", 27-32", 7-8", 29-32", 15-16", 31-32", 1"		3.75
Square: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16"		4.75
Hexagonal: 1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4", 13-16", 7-8"		4.75
Metric, Round: 10 m/m to 25 m/m, varying by 1 m/m		3.75
Feeding Finger Blanks		1.80

No. 22B Spring Collets, for use with 1 1-8" Feed Tube

English, Round: 1 1-16", 1 1-8"		8.00
Hexagonal: 15-16"		12.00
Metric, Round: 26, 27, 28 m/m		8.00
Collet Blanks		4.75

No. 22A Feeding Fingers, for 1 1-8" Feed Tube

English, Round: 1 1-16", 1 1-8"		4.75
Hexagonal: 15-16"		8.00
Metric, Round: 26, 27, 28 m/m		4.75
Feeding Finger Blanks		3.00

Nos. 2 and 2G Automatic**No. 22A Spring Collets, for use with Outside Feeding Attachment, for Machines with 1 5-16" Hole in Spindle**

Round: 1 1-16", 1 1-8", 1 3-16", 1 1-4"		\$3.00
Hexagonal: 1", 1 1-16", 1 1-8"		12.00
Collet Blanks		4.75

No. 22B Spring Collets, for use with Outside Feeding Attachment, for Machines with 1 7-16" Hole in Spindle

English, Round: 1 1-16", 1 1-8", 1 3-16", 1 1-4", 1 5-16", 1 3-8"		8.00
Hexagonal: 1", 1 1-16", 1 1-8", 1 3-16"		12.00
Metric, Round: 26 m/m to 35 m/m, varying by 1 m/m		8.00
Collet Blanks		4.75

No. 22B Feeding Fingers, for use with Outside Feeding Attachment

English, Round: 1 1-16", 1 1-8", 1 3-16", 1 1-4", 1 5-16", 1 3-8"		8.75
Hexagonal: 1", 1 1-16", 1 1-8", 1 3-16"		12.75
Metric, Round: 26 m/m to 35 m/m, varying by 1 m/m		8.75
Feeding Finger Blanks		6.25

*List continued on next page.**Other sizes made to order.*

Spring Collets and Feeding Fingers (*Continued*)

No. 4 Automatic Screw Machine

Price each

No. 24M Master Spring Collets (Slotted three times for round and hexagonal stock, four times for square stock)

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 1-2" diameter, and any size hexagonal stock to and including 1 5-16" across flats \$16.00

Square: Takes interchangeable sets of pads for any size square stock to and including 1 5-16" across flats 17.50

***Pads for No. 24M Master Spring Collets**

Round: Any size to and including 1 1-2", set of three 6.75

Hexagonal: To and including 1 5-16", set of three 9.25

Square: Any size to and including 1 5-16", set of four 9.25

No. 24M Master Feeding Fingers (Slotted three times for round or hexagonal stock, four times for square stock)

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 1-4" diameter, and any size hexagonal stock to and including 1 1-16" across flats 12.00

Square: Takes interchangeable sets of pads for any size square stock to and including 1 1-16" across flats 14.00

***Pads for No. 24M Master Feeding Fingers**

Round: Any size to and including 1 1-4", set of three 4.75

Hexagonal: To and including 1 1-16", set of three 6.50

Square: Any size to and including 1 1-16", set of four 6.50

***No. 24 Feeding Fingers (Regular Style)**

Round: Any size from 1 5-16" to 1 1-2", inclusive 12.00

Hexagonal: Any size from 1 1-8" to 1 5-16", inclusive 16.00

***Feed Tube Bushings**

Used in rear end of feed tube for steadying and supporting the bar. Round bushings used for round, square or hexagonal stock. In specifying size wanted, add 1-32" to diameter or distance across corners of stock.

Round: 25-32" to 1 17-32", inclusive, by 16ths 2.00

***No. 24 Spring Collets for use with Outside Feeding Attachment**

Round: Any size from 1 9-16" to 1 7-8", inclusive 16.00

Hexagonal: Any size from 1 3-8" to 1 5-8", incl., across flats 20.00

No. 24MB Master Feeding Fingers for use with Outside Feeding Attachment

Round: Takes interchangeable sets of pads for any size round stock from 1 9-16" to 1 7-8", inclusive 16.50

Hexagonal: Takes interchangeable sets of pads for any size hexagonal stock from 1 3-8" to 1 5-8", inclusive 16.50

Square: Takes interchangeable sets of pads for any size square stock from 1 1-8" to 1 5-16", inclusive 16.50

***Pads for No. 24MB Master Outside Feeding Fingers**

Round: From 1 9-16" to 1 7-8", inclusive, set of four 5.25

Hexagonal: From 1 3-8" to 1 5-8", inclusive, set of four 7.25

Square: From 1 1-8" to 1 5-16", inclusive, set of four 7.25

* Made to order only.

Spring Collets and Feeding Fingers (Continued)**No. 6 Automatic Screw Machine**

Price each

No. 26M Master Spring Collets (Slotted three times for round and hexagonal stock and four times for square stock)	
Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 2" diameter, and any size hexagonal stock to and including 1 3-4" across flats	\$17.50
Square: Takes interchangeable sets of pads for any size square stock to and incl. 1 11-16", across flats	19.50
Pads for No. 26M Master Spring Collets	
Round: 3-4" to and including 2" by 16ths, set of three	6.75
*Hexagonal: Any size to and including 1 3-4", set of three	9.25
*Square: Any size to and including 1 11-16", set of four	9.25
No. 26M Master Feeding Fingers (Slotted three times for round and hexagonal stock and four times for square stock)	
Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 3-4" diameter, and any size hexagonal stock to and including 1 1-2" across flats	13.50
Square: Takes interchangeable sets of pads for any size square stock to and including 1 7-16" across flats	16.00
Pads for No. 26M Master Feeding Fingers	
Round: 3-4" to and including 1 3-4" by 16ths, set of three	4.75
*Hexagonal: Any size to and including 1 1-2", set of three	6.50
*Square: Any size to and including 1 7-16", set of four	6.50
No. 26 Feeding Fingers (Regular Style)	
Round: Any size from 1 13-16" to 2", inclusive, by 16ths	13.50
*Hexagonal: Any size from 1 9-16" to 1 3-4", inclusive	17.50
Feed Tube Bushings	
Used in rear end of feed tube for steadying and supporting the bar. Round bushings used for round, square or hexagonal stock. In specifying size wanted, add 1-32" to diameter or distance across corners of stock.	
Round: 25-32" to and including 2 1-32" diameter, by 16ths	2.25
No. 26 Spring Collets, for use with Outside Feeding Attachment	
Round: Any size from 2 1-16" to 2 3-8", inclusive	17.50
*Hexagonal: Any size from 1 13-16" to 2", inclusive	21.50
No. 26MB Master Feeding Fingers, for use with Outside Feeding Attachment	
Round: Takes interchangeable sets of pads for any size round stock from 2 1-16" to 2 3-8", inclusive	19.50
*Hexagonal: Takes interchangeable sets of pads for any size hexagonal stock from 1 13-16" to 2", inclusive	19.50
*Square: Takes interchangeable sets of pads for any size square stock from 1 1-2" to 1 11-16", inclusive	19.50
Pads for No. 26MB Master Feeding Fingers	
Round: Any size from 2 1-16" to 2 3-8", inclusive, by 16ths, set of four	5.25
*Hexagonal: Any size from 1 13-16" to 2", incl., set of four	7.25
*Square: Any size from 1 1-2" to 1 11-16", incl., set of four	7.25

* Made to order only.

Extra Size Feed Tubes and Fingers

FOR WIRE FEED AND AUTOMATIC SCREW MACHINES

These feed tubes and fingers are somewhat lighter in construction than those regularly furnished with the machines. As they allow stock to be used of larger diameter than the rated capacity of the machines, they are offered for use only on brass or other work requiring comparatively light cuts.

Be sure to specify serial number of machine when ordering.

No. of Machine	Machine Serial No.	Largest Diameter of Stock, Inches			Fingers, how Attached	Price Tube without Finger	Price Tube with Round Finger
Wire Feed		Round	Hex-Flats	Square			
0	96 to 371	17-32	29-64	3-8	One Piece	.....	\$19.50
	96 to 371	1-2	7-16	23-64	Soldered	\$12.00	15.00
	begin 372	1-2	7-16	23-64	Threaded	16.00	19.50
1	prior to 227	9-16	1-2	13-32	Soldered	12.00	15.00
	prior to 227	5-8	17-32	29-64	One Piece	.....	19.50
	227 to 495	3-4	21-32	35-64	Soldered	13.75	16.75
2 and 2F	begin 496	3-4	21-32	35-64	Threaded	18.50	21.50
	prior to 383	1	7-8	23-32	Soldered	25.50	29.25
	383 to 863	1 1-16	15-16	3-4	Soldered	25.50	29.25
Automatic	begin 864	1 1-8	31-32	25-32	Threaded*	35.50	39.25
00	prior to 3448	3-8	21-64	17-64	Soldered	9.75	12.00
00G	prior to 3098	3-8	21-64	17-64	Threaded	9.75	12.00
00	begin 3448	3-8	21-64	17-64	Threaded	9.75	12.00
00G	begin 3098	3-8	21-64	17-64	Threaded	9.75	12.00
0	prior to 2015	9-16	1-2	13-32	Soldered	12.00	15.00
0G	prior to 2215	5-8	17-32	29-64	One Piece	.....	19.50
0	prior to 2015	5-8	17-32	29-64	Threaded	12.00	15.00
0G	prior to 2215	5-8	17-32	29-64	Threaded	12.00	15.00
0	begin 2015	5-8	17-32	29-64	Threaded	12.00	15.00
0G	begin 2215	5-8	17-32	29-64	Threaded	12.00	15.00
1		11-16	39-64	1-2	Soldered	16.00	19.00
1		3-4	21-32	35-64	One Piece	.....	23.00
2	prior to 2255	1 1-16	15-16	3-4	Soldered	25.50	29.25
2G	prior to 2205	1 1-8	31-32	25-32	Threaded*	35.50	39.25
2	begin 2255	1 1-8	31-32	25-32	Threaded*	35.50	39.25
2G	begin 2205	1 1-8	31-32	25-32	Threaded*	35.50	39.25

* Special chuck nut and chuck sleeve are included with the feed tube.

Extra Capacity Collets

We can furnish extra capacity collets and chucks for second operation work larger than rated bar capacity on Plain, Wire Feed and Automatic Screw Machines. These are automatically operated and have no end movement on the work. Largest diameter taken: No. 0 Wire Feed, 1 3-4"; No. 1 Wire Feed, 2 1-2"; Nos. 2 and 2F Wire Feed, 2 and 2G Automatic, 3"; Nos. 00 and 00G Automatic, 1 3-8"; Nos. 0 and 0G Automatic, 2"; No. 4 Automatic, 4"; No. 6 Automatic, 5"; Nos. 4 Plain and 4 Wire Feed, 6"; Nos. 6 Plain and 6 Wire Feed, 7". Equipment: Collet blank, sleeve and holding rod; for two latter capacities chuck and holding rod. Prices on application.

As these collets are intended only for special work, it is necessary for us to have details regarding the work to be done before quoting prices.

Circular Cutting-Off and Forming Tool Blanks

FOR AUTOMATIC SCREW MACHINES

Blanks for Cutting-Off and Forming Tools are made of either carbon or high-speed steel. They are turned to size and drilled and tapped for clamping screw. Specify thickness when ordering.

No. of Machine where used	Diameter, Inches	Thickness, Inches	Carbon Steel Price each	High-Speed Steel Price each
00, 00G & 19 Auto.	1 3-4	1-4 to 1-2 by 16ths	\$0.90	
00, 00G & 19 Auto.	1 3-4	9-16 to 1 by 16ths	1.25	
0 & 0G Automatic	2 1-4	5-16 to 5-8 by 16ths	1.25	
0 & 0G Automatic	2 1-4	11-16 to 1 1-8 by 16ths	1.75	
1 Automatic	2 1-2	3-8 to 7-8 by 16ths	2.00	
1 Automatic	2 1-2	15-16 to 1 1-4 by 16ths	3.00	
2 & 2G Automatic	3	3-8 to 13-16 by 16ths	2.00	
2 & 2G Automatic	3	7-8 to 1 1-4 by 16ths	3.00	
*4 Automatic	3 1-2	1-2, 5-8, 3-4, 7-8	5.60	
*4 Automatic	3 1-2	1, 1 1-4, 1 1-2	6.75	
*4 Automatic	3 1-2	1 3-4, 2	8.50	
*6 Automatic	4	1-2, 5-8, 3-4, 7-8	6.25	
*6 Automatic	4	1, 1 1-4, 1 1-2	7.25	
*6 Automatic	4	1 3-4, 2	9.25	
*6 Automatic	4	2 1-4, 2 1-2	12.00	
*6 Automatic	4	2 3-4	13.75	

* Made to order only.

Cam Blanks

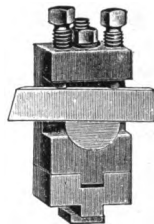
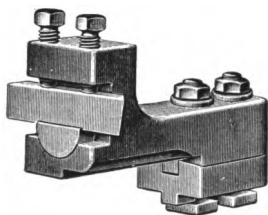
FOR AUTOMATIC SCREW MACHINES

Cam Blanks are put up in sets of three, 2 Cross Slide and 1 Lead Cam. They are made of mild steel and all except those for the Nos. 4 and 6 Automatic Screw Machines are bored and turned and graduated into 100 parts to assist in laying out the cam. Cam Blanks for Nos. 4 and 6 Automatic Screw Machines are provided with necessary holes, but are left square and are not graduated.

No. of Machine where used	Diam. Cross Slide, Inches	Price each	Diam. Lead, Inches	Price each	Price per Set 2 Cross Slide and 1 Lead Cam
00, 00G and 19 Automatic Screw	4 1-2	\$1.00	4 1-2	\$1.00	\$3.00
			5	1.00	3.00
			6	1.30	3.90
0 and 0G Automatic Screw	6	1.30	6 1-2	1.30	3.90
			7	1.30	3.90
			7	1.70	5.10
1, 2 and 2G Automatic Screw	7	1.70	8	1.70	5.10
			9	2.00	5.40
			12	5.70	10.50
No. 4, Auto. Screw	8	2.40	12	5.70	10.50
No. 6, Auto. Screw	9	3.00	15	9.00	15.00

Turret Tool Posts

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES



Nos. 24A and 26A Turret Tool Posts (short style) and Nos. 24B and 26B Turret Tool Posts (long style) are used either together or singly for turning operations. The raising block with each allows post to be used with spindle running in either direction. They will turn to capacity of machine. Other tools can often be used at same time in advance or in rear of these posts.

No.	No. of Machine where used	Price
24A } 24B } 26A } 26B }	4 Automatic	\$18.00 28.00 18.00 28.00
	6 Automatic	

Box Tools (Style 1)

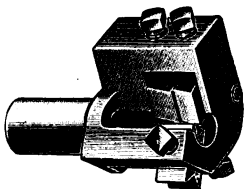
This style of box tool is used for general work, for turning one or two diameters as required. When one diameter is being turned with a tool carrying two blades, the blade in the rear is pushed back out of action.

The back rests are beveled on both ends to increase their capacity, one end being for work of small diameter and the other for large work. Plain V rests only are used on this style.

Nos. 00B, 00C, 00D and 20C are equipped with one blade; all the others have two blades. One set of blades and back rests is furnished.

Nos. 00C, 20, 20A, 20B, 20C and 22B are arranged to hold a centre drill or pointing tool in the shank, clamped in position by a set screw. A centre drill

is furnished with the No. 00C.



No.	No. of Machine where used	Diameter that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diameter of Shank, Inches	Length of Shank, Inches	Price
00	00, 00G & 19 Auto.	1-4	1 1-4	1 3-8	5-8	1 3-8	\$16.00
†00A	00, 00G & 19 Auto.	1-4	1 1-4	1 3-8	5-8	1 1-8	19.00
00B	00, 00G & 19 Auto.	3-16	1 1-4	3-4	5-8	1 3-4	8.75
*00C	00, 00G & 19 Auto.	1-4	5-8	1 3-8	5-8	1 1-8	17.00
†00D	00, 00G & 19 Auto.	3-16	1 1-4	3-4	5-8	1 3-4	12.00
20	0 & 0G Automatic	1-2	1 5-8	2 3-16	3-4	1 1-2	19.00
†20A	0 & 0G Automatic	1-2	1 5-8	2 3-16	3-4	1 1-2	23.50
20B	0 & 0G Automatic	1-4	2	2 3-16	3-4	1 1-2	17.75
20C	0 & 0G Automatic	1-2	3-4	1 1-4	3-4	1 1-2	19.00
22B	2 & 2G Automatic	5-8	2	2 5-8	1	2 1-4	27.50

* With Centre Drill.

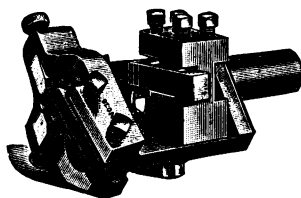
† Left Hand.

Box Tools (Style 2)

These tools have roller back rests for the front blades and plain V rests for the rear. The rollers materially reduce the friction on heavy cuts and are adjustable for different diameters. Plain rests are beveled on both ends to increase their range.

The rear tool post is fitted to take blade on either front or back side, or both. It is adjustable along the body of the box tool, allowing for different distances between the front and rear blades.

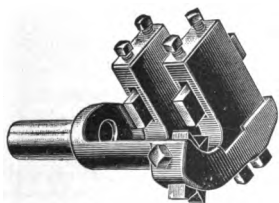
One set of blades and back rests is furnished.



No.	No. of Machine where used	Diameter that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
12	2 and 2F W. F.; 2 Pl.	1	3 1-2	4 1-8	1	2 1-2	\$35.50
14	{ 4 Pl. 428 to 601* 4 W. F. prior to 23* }	1 1-4	4 1-2	5 1-4	1 1-2	3 1-4	50.00
34	{ 4 Pl.; 4 W. F. 5 Pl. }	1 1-4 1 1-8	4 1-2 8	5 1-4	1 3-4	3 1-4	50.00
16	{ 5 Pl. 428 to 581* 6 Pl. 59 to 230* }	1 1-2	5	5 5-8	1 1-2	3 1-4	59.00
36	6 Pl.; 6 W. F.	1 1-2 1 3-8	5 10	5 1-2	2	3 1-4	59.00

* Be sure to give serial number of machine.

Box Tools (Style 3)



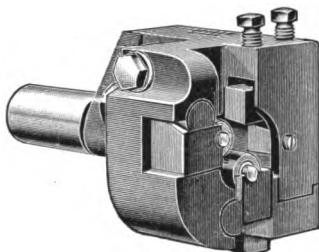
The front tool holder is fixed in position; the rear tool holder is adjustable along the body of the tool, allowing for different distances between the blades. The holders are made narrow to allow the tools to be set close together when desired. The back rest is beveled on both ends, one end being used for large and one for small diameters. No. 22 Box Tool differs from cut in having three tool holders with back rests, the two rear tool holders being adjustable, it is also

arranged to hold a centre drill in the shank. The drill is not included in prices of tool. One set of blades and back rests is furnished.

No.	No. of Machine where used	Diameter that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
20D	0 and 0G Auto.	3-8	2	2 3-16	3-4	1 1-2	\$27.50
21	1 Automatic	1-2	2	2 5-8	1	1 3-4	27.50
22	2 and 2G Auto.	7-8	2 3-8	3	1	2	35.50
10	0 Wire Feed	3-8	1 3-4	2 3-16	5-8	1 7-16	27.50
11	1 W. F.; 1 Pl.	1-2	2 1-4	2 11-16	3-4	2	27.50
13		1	3	3 3-4	1 1-4	3 1-4	43.00

Box Tools

Style 4

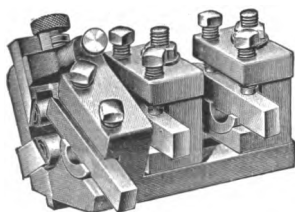


The blade is in a fixed position and the back rests adjustable. The back rests are of the roller type to reduce friction. This tool is intended for work requiring one finishing cut of 3-32" or less.

No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00E	00, 00G & 19 Auto.	1-4	1 1-4	1 3-8	5-8	1 1-8	\$34.00
10E	0 Wire Feed	3-8	1 3-4	2 3-16	5-8	1 7-16	40.00
11E	1 Wire Feed	1-2	2 1-4	2 11-16	3-4	2	46.00
20E	0 & 0G Auto.	1-2	1 5-8	2 3-16	3-4	1 1-2	40.00
22E	2 & 2G Auto.	7-8	2 3-8	3	1	2	52.00

Box Tools

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES



These tools have three blades providing means for turning as many as three diameters at once when required. Two of the blades are sometimes used for turning and the third for pointing. The two rear tool holders are adjustable along the tool body and may be reversed.

The work is supported by a roller back rest opposite the front blade, and a plain V rest between the rear blades.

No.	No. of Machine where used	Turning Capacity, Inches	Price
24	4 Automatic	1-4 to 1 1-2 diam.	\$73.00
26	6 Automatic	1-2 to 1 3-4 diam.	80.00



Drill Holders

Drills are held directly in holder or in a bushing. One blank bushing furnished with each holder. Bushings listed below.

No.	No. of Machine where used	Diam. of Hole for Drill or Bushing, Inches	Depth of Hole, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00 & 00G Auto.	5 Taper	.5-8	7-8	5-8	1 1-8	\$3.75
00A	00 & 00G Auto.	1-2	11-16	7-8	5-8	1 1-8	4.00
10	0 Wire Feed	1-2	11-16	1	5-8	1 7-16	4.00
11	1 W. F. & 1 Plain	5-8	13-16	1 1-8	3-4	2	4.00
12	2 & 2F W. F. & 2 Pl.	1	1 3-16	1 5-8	1	2 1-2	6.25
14	{ 4 Pl. 428 to 601* 4 W. F. prior to 23* }	1	1 3-16	1 7-8	1 1-2	3 1-4	7.00
16	{ 5 Pl. 428 to 581* 6 Pl. 59 to 230* }	1 1-2	1 5-8	2 1-4	1 1-2	3 1-4	8.00
20	0 & 0G Auto.	5-8	13-16	1	3-4	1 15-16	4.00
21	1 Automatic	3-4	15-16	1 1-4	1	1 3-4	4.75
22	2 & 2G Auto.	1	1 3-16	1 7-16	1	1 3-4	6.25
34	4 Plain & 4 W. F.	1 1-2	1 5-8	2 1-4	1 3-4	3	8.00
36	6 Plain & 6 W. F.	1 1-2	1 5-8	2 1-4	2	3 1-4	8.00

* Be sure to give serial number of machine.

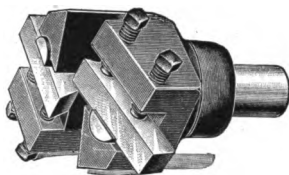
Bushings and Bushing Blanks

These Bushings are used for holding drills, taps, reamers, etc., in Drill Holders, Tap Holders or Floating Holders. A blank bushing is shown with the Tap Holder on page 320. The tool is clamped securely in the bushing when the set screw in the holder bears upon the flat on the bushing shoe.

The Bushing Blanks are turned to size and are provided with a shoe for clamping the tool.

No.	No. of Drill, Tap or Floating Holders where used	Outside Diameter, Inches	Length, Inches	Price Finished Bushing	Price Bushing Blank
00	00	5 Taper	11-16	\$2.20	\$0.55
00A	00A Tap Holder	1-4	7-16	2.20	.55
10	00A, 00C, 10	1-2	3-4	2.20	.55
00B	00B	1-2	9-16	2.20	.55
11	11, 20, 20B	5-8	7-8	2.20	.55
21	21	3-4	1	2.20	.65
12	12, 13, 14, 22, 22B	1	1 1-4	2.20	.65
16	{ 16, 34, 36 26 Tap Holder }	1 1-2	1 3-4	3.00	.85
26	{ 26 Float. Holder, Ext. 26 Floating Holder }	2	1 7-8	3.25	1.25

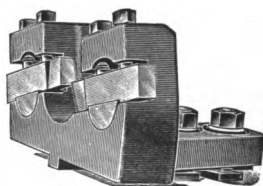
Balance Turning Tools



These tools are intended for roughing cut only. One blade set to remove one-half the clip, the opposite blade set to the roughing size and ground slightly behind the other. Tools are fitted with high-speed steel blades.

No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
*00A	00, 00G & 19 Auto.	11-32	1 1-4	1	5-8	1 3-8	\$34.00
00B	00, 00G & 19 Auto.	11-32	1 1-4	1	5-8	1 3-8	32.00
10	0 Wire Feed	3-8	2	2 3-16	5-8	1 7-16	34.00
11	1 W. F. & 1 Pl.	5-8	2 1-2	2 3-4	3-4	2	40.00
12	2 & 2F W. F., 2 Pl.	1	3 5-8	4 1-8	1	2 1-2	52.00
20	0 & 0G Auto.	5-8	2	2 3-16	3-4	1 3-4	40.00
20B	0 & 0G Auto.	11-32	2	4	3-4	1 3-4	32.00
22	2 & 2G Auto.	1	2 5-8	3	1	1 3-4	46.00
34	4 W. F. & 4 Pl.	1 1-2	4 3-4	5 1-4	1 3-4	3 1-4	57.00
		15-16	8	....	....	....	....

* Left Hand.

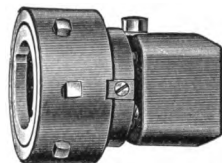


No.	No. of Machine where used	Diam. that can be turned, Inches	Length that can be turned, Inches	Method of Attaching	Price
24	4 Auto.	1 1-2	4	Clamps on face of turret	\$46.00
26	6 Auto.	2	5	Clamps on face of turret	52.00
36	6 W. F. & 6 Pl.	1 15-16	10	Screws on face of turret	63.00

Die Holders

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

These Die Holders are of the plain, draw-out type. Three caps, having inside diameters of 2", 2 1-2" and 3" are furnished. Stock sizes Carpenter's dies used: 5-8" x 2", 11-16" x 2 1-2", 1 1-16" x 3".



No.	No. of Machine where used	Threading Capacity, Inches	Price
24	4 Automatic	To 1 3-16" diam.	\$38.00
26	6 Automatic	To 1 7-16" diam.	38.00

Opening Die Holders

FOR AUTOMATIC SCREW MACHINES

The use of these Die Holders obviates the necessity of reversing the spindle to back the die off threaded work. They are especially useful for threading operations when only one spindle pulley is available for driving, or on machines not arranged to reverse. All sizes of these die holders carry four chasers.

No.	No. of Machine where used	Capacity, Inches	Price without Chasers
00	00 and 00G Automatic	1-8 to 5-16	\$30.00
20	0 and 0G Automatic	1-8 to 9-16	40.00
22	2 and 2G Automatic	1-4 to 3-4	50.00

Closers for Opening Die Holders

The Die Closer is attached to a finished pad on the front of the Automatic Screw Machine provided for the purpose. It can then be adjusted to engage the pin on the Opening Die Holder and close the die as the turret is rotated after the threading operation.

No. 20 for use on Nos. 0 and 0G Automatic Screw Machines . . . \$10.50
 No. 22 for use on Nos. 2 and 2G Automatic Screw Machines . . . 12.50

Tap Holders



The Tap Holders in the accompanying table marked "releasing" are for any Screw Machine operated by hand and have an improved clutch mechanism which avoids the hard shock and jar usual with such tools when released. The parts subject to wear are small and easily renewed. All parts are hardened. One blank bushing is furnished.

Bushings listed, page 315.

No. of Holder	No. of Machine where used	Releasing	Diameter of Hole for Tap or Bushing, Inches	Depth of Hole to Receive Tap, Inches	Length of Body, Inches	Diameter of Shank, Inches	Length of Shank, Inches	Price
00	00 & 00G Automatic	No	No. 5 Taper	5-8	15-16	5-8	1 1-8	\$8.00
00A	00 & 00G Automatic	No	1-4	3-8	15-16	5-8	1 1-8	6.25
00B	00 & 00G Automatic	Yes	1-2	1-2	1 1-16	5-8	1 1-8	8.75
00C	00 & 00G Automatic	No	1-2	11-16	15-16	5-8	1 1-8	8.00
10	0 Wire Feed	Yes	1-2	11-16	1 5-16	5-8	1 7-16	9.75
11	1 W. F. & 1 Plain	Yes	5-8	13-16	1 7-16	3-4	2	10.75
12	2 & 2F W. F. & 2 Pl.	Yes	1	1 3-16	2	1	2 1-2	13.75
13		Yes	1	1 3-16	2 1-2	1 1-4	3 1-4	19.25
14	{ 4 Plain 428 to 601* 4 W. F. prior to 23* 5 Plain 428 to 581* 6 Plain 59 to 230* }	Yes	1	1 3-16	2 1-2	1 1-2	3 1-4	19.25
16		Yes	1 1-2	1 5-8	2 7-8	1 1-2	3 1-4	29.50
20		No	5-8	13-16	1 7-16	3-4	1 1-2	8.75
20B	0 & 0G Automatic	Yes	5-8	13-16	1 7-16	3-4	1 1-2	10.75
21	0 & 0G Automatic	No	3-4	15-16	1 1-2	1	1 3-4	9.75
21	1 Automatic	No	1	1 3-16	1 9-16	1	2	9.75
22	2 & 2G Automatic	Yes	1	1 3-16	2	1	2	13.75
22B	2 & 2G Automatic	Yes	1 1-2	1 5-8	2 7-16	1 3-4	3	23.50
34	4 Plain & 4 W. F.	Yes	1 1-2	1 5-8	2 7-8	2	3 1-4	29.50
36	6 Plain & 6 W. F.	Yes	1 1-2	1 5-8	2 7-8	2	3 1-4	29.50

* Be sure to give serial number of machine.

Die Holders

Die Holders are either of plain, drawout style or releasing style. The latter have an improved clutch mechanism which prevents the usual hard shock on releasing. Parts subject to wear are hardened.

Extra capacity die caps and bushings can be furnished to take larger dies on following holders: For No. 00B takes die 1-4" x 13-16" — \$2.50; for Nos. 11, 20 and 20B, takes die 1-2" x 1 1-2" — \$5.00; for Nos. 12, 22 and 22B, takes die 5-8" x 2" — \$6.00.



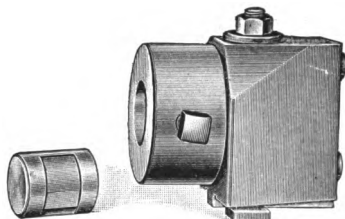
No. of Holder	No. of Machine where used	Releasing	Capacity		Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Dies Used, Carpenter's Stock Sizes, Inches	Price
			Dia. Thd., Inches	Lth. Thd., Inches					
00B	00 & 00G Auto.	Yes	1-4	3-4	1 7-16	5-8	1 1-8	1-4 x 5-8	\$9.75
00E	00 & 00G Auto.	No	5-16	1	1 3-8	5-8	1 1-4	1-4 x 5-8	9.75
10	0 Wire Feed	Yes	9-32	1	1 11-16	5-8	1 7-16	1-4 x 13-16	9.75
11	1 W. F. & 1 Plain	Yes	3-8	1	1 13-16	3-4	2	1-4 x 13-16	12.00
12	2 & 2F W. F. & 2 Pl.	Yes	1-2	2 3-8	2 3-8	1	2 1-2	5-16 x 1	16.00
13		Yes	3-4	2 1-2	3 1-4	1 1-4	3 1-4	1-2 x 1 1-2	29.50
14	4 Pl. 428 to 601*	Yes	3-4	2 1-2	3 1-4	1 1-2	3 1-4	1-2 x 1 1-2	31.00
16	4 W. F. prior to 23*		1 1-16	2 3-4	3 5-8	1 1-2	3 1-4	5-8 x 2	39.00
	5 Pl. 428 to 581*							11-16 x 2 1-2	
	6 Pl. 59 to 230*	No	3-8	1 1-4	1 3-4	3-4	1 3-4	1-4 x 13-16	9.75
20	0 & 0G Automatic		3-8	1	1 13-16	3-4	1 1-2	1-4 x 13-16	12.00
20B	0 & 0G Automatic		3-8	2	2 5-8	1	1 3-4	1-4 x 13-16	13.75
21	1 Automatic	No	1-2	1 3-4	2 3-8	1	2	5-16 x 1	12.00
22	2 & 2G Automatic	No	1-2	2 3-8	2 3-8	1	2	5-16 x 1	16.00
22B	2 & 2G Automatic	Yes	1-2	2 3-8	2 3-8	1 3-4	3	5-8 x 2	39.00
34	4 & 5 Pl.; 4 W. F.	Yes	†1	†2 3-4	3 5-8	2		11-16 x 2 1-2	
36	6 Pl.; 6 W. F.	Yes	†1 1-2	†3 1-8	4			5-8 x 2	
								{ 11-16 x 2 1-2 1 1-16 x 3 }	50.00

* Be sure to give serial number of machine.

† 13-16" — 8" long.

‡ 1 1-16" — 10" long.

Tap Holders



FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

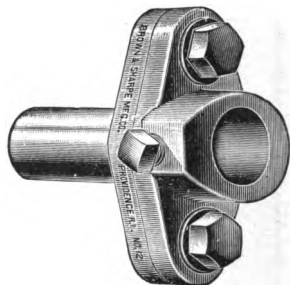
These Tap Holders are of plain drawout style, holding the tap in a bushing, one blank bushing being furnished.

No.	No. of Machine where used	Size of Hole for Tap or Bushing	Tap Holder	Price, Fin. Bushings	Price of Blanks
24	4 Automatic	{ 1 1-4" diameter 1 1-2" deep 1 1-2" diameter 1 5-8" deep	\$19.50	\$3.00	\$0.85
26	6 Automatic				

Floating Holders

**For Holding Drills, Reamers,
Counterbores, Etc., in the Turret**

The holder and shank are separate and after a tool is adjusted central with the work, the two are clamped together. One blank bushing is furnished. Bushings listed, page 315.



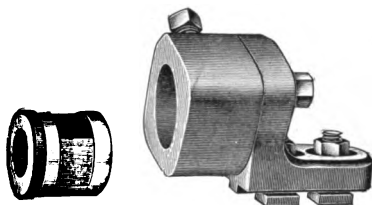
No.	No. of Machine where used	Diam. of Hole for Drill or Bushing, Inches	Depth of Hole, Inches	Length of Body, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
00	00, 00G & 19 Auto.	5 Taper	5-8	15-16	5-8	1 1-8	\$6.25
00A	00, 00G & 19 Auto.	1-2	11-16	27-32	5-8	1 1-8	6.25
10	0 Wire Feed	1-2	11-16	29-32	5-8	1 7-16	6.25
11	1 W. F. & 1 Pl.	5-8	13-16	1 1-8	3-4	2	7.00
12	2 & 2F W. F. & 2 Pl.	1	1 3-16	1 1-2	1	2 1-2	8.00
14	4 Pl. 428 to 601*	{ 1 1 1-2	1 3-16	1 9-16	1 1-2	3 1-4	8.75
16	4 W. F. prior to 23*		1 5-8	2 5-32	1 1-2	3 1-4	12.00
	5 Pl. 428 to 581*						
	6 Pl. 59 to 230*						
20	0 & 0G Automatic	5-8	13-16	1 1-8	3-4	2	7.00
21	1 Automatic	3-4	15-16	1 1-4	1	2 1-2	9.75
22	2 & 2G Automatic	1	1 3-16	1 1-2	1	1 3-4	8.00
34	4 Pl. & 4 W. F.	1 1-2	1 5-8	2 5-32	1 3-4	3	10.75
36	6 Pl. & 6 W. F.	1 1-2	1 5-8	2 5-32	2	3 1-4	12.00

* Be sure to give serial number of machines.

Floating Holders

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

These Floating Holders hold drills, reamers, etc. which can be set central with work and then the floating head clamped. One bushing blank is furnished.



No.	No. of Machine where used	Diam. of Hole for Bushing, Ins.	Price of Holder	Price of Bushing Blanks
24	4 Automatic 6 Automatic }	2	\$16.00	\$1.25
26				

Floating Holder Extension

FOR USE WITH No. 26 FLOATING HOLDER

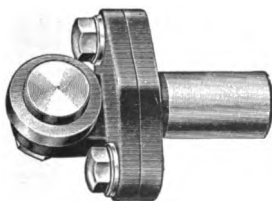
The No. 26 Floating Holder Extension fits into the hole of the No. 26 Floating Holder, and is used in connection with this tool for holding small or short drills, reamers, etc.

Diameter of hole for bushing, 1 1-2".

Price, \$14.00.

Pointing Tool Holders

FOR CIRCULAR TOOLS



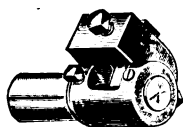
For use in the turret of Automatic Screw Machines for pointing or forming the end of the work. The circular tool may be readily removed and ground without changing its form.

The holder and shank are separate, and after the tool is adjusted central with the work the two are clamped together. One tool blank is furnished with holder.

No.	No. of Machine where used	Length Body, Ins.	Length Shank, Ins.	Diameter Shank, Ins.	Diam. Tool Blank, Ins.	Price
00A	00, 00G and 19 Auto.	1 3-8	1 1-8	5-8	1 1-8	\$16.00
20A	0 and 0G Auto.	1 9-16	1 11-16	3-4	1 3-8	19.50
22A	2 and 2G Auto.	1 15-16	1 3-4	1	1 3-4	27.00

Circular Pointing Tool Blanks

For use with the Holder shown at bottom of preceding page. Carbon Steel. Price of blanks for use on Nos. 00, 00G and 19 Automatic, \$0.55; for use on Nos. 0 and 0G Automatic, \$0.55; for use on Nos. 2 and 2G Automatic, \$0.75.



Pointing Tools (Style 1)

Pointing Tools of all styles are provided with a bushing or a plain V rest which precedes the blade to support the work. The blade is adjustable.

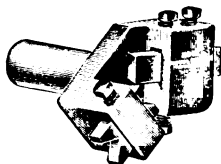
Style 1 is provided with 1 blade and blank bushing.

No.	No. of Machine where used	Capacity, Inches	Length of Body, Inches	Distance front of Bushing to Tool, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
100B	00, 00G & 19 Auto.	3-16	11-16	3-16	5-8	1 13-16	\$9.75
100C	00, 00G & 19 Auto.	1-4	1 3-16	5-16	5-8	1 5-16	10.75
100D	00, 00G & 19 Auto.	3-16	11-16	3-16	5-8	1 3-16	16.00
20B	0 & 0G Automatic	1-2	1 1-2	3-8	3-4	1 3-4	17.50
22B	2 & 2G Automatic	7-8	1 7-8	1-2	1	2 1-2	23.50

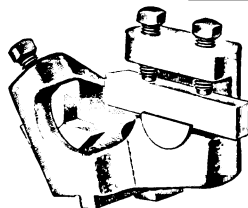
† Not provided with set screw for clamping tool in shank as shown in cut.

Pointing Tools (Style 2)

This style of Pointing Tool is provided with 1 blade and back rest.



No.	No. of Machine where used	Capacity, Inches	Length of Body, Inches	Distance front of Rest to Tool, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Price
12	{ 2 and 2 F W. F.; 2 Pl. }	1-4 to 3-4	1 13-16	3-8	1	2 1-2	\$23.50
34	4 Pl.; 4 W. F.	1-4 to 1 1-4	2 3-4	1-2	1 3-4	3	34.00
36	6 Pl.; 6 W. F.	1-2 to 1 1-2	2 15-16	5-8	2	3 1-4	43.00



Pointing Tools

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

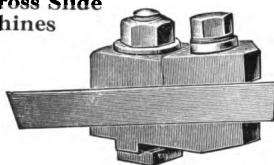
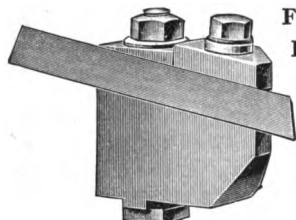
These Pointing Tools are provided with 1 blade and 1 V back rest preceding the tool.

No.	No. of Machine where used	Points Work	Front Back Rest to Tool Blade, In.	Price
24	4 Automatic	To 1 1-2" diam.	9-16	\$46.00
26	6 Automatic	To 1 1-2" diam.	9-16	49.00

Cutting-Off Tool Posts

FOR THIN BLADE TOOLS

For Use on the Cross Slide
of Screw Machines



High, for back cross slide, and low for front cross slide, are used when spindle runs forward.

Low for back cross slide is used when spindle runs backward.

One blade is furnished with tool post.

No.	Style	No. of Machine where Used	Top of Cross Slide to Center of Spindle, Inches	Price
00	High back, low bk., low frt.	00 & 00G Auto.	1	\$8.00
10	High back	0 Wire Feed	1 9-16	10.75
11	High back	1 W. F. & 1 Plain	2 1-16	12.00
12	High back	2 & 2F W. F. & 2 Pl. 4 W. F. prior to 23* 4 Pl. prior to 602* 5 Pl. prior to 553* 6 Pl. 8 to 230*	2 1-2	13.00
16	High back	0 & 0G Automatic	2 15-16	13.75
20	High back, low bk., low frt.	1 Automatic	1 5-16	9.75
21	High back and low back	2 & 2G Automatic	1 7-16	13.75
22	High back, low bk., low frt.		1 7-16	13.75

* Be sure to give serial number of machine.

Blades for Cutting-Off Tool Posts

For Post No.	Thickness, Inches	Width, Inches	Carbon Steel, Price each
00	1-32, 1-16, 5-64, 3-32	1-2	\$0.65
10	1-16, 3-32, 1-8	11-16	.65
11, 12 & 16	1-16, 3-32, 1-8	13-16	.55
	5-32		.60
	3-16		.65
20, 21 & 22	1-16, 3-32, 1-8	11-16	.65
For No. 6 Auto.	3-16	1	.80

Stock Stops for Screw Machine Turret

The stops are finished tapered on one end and are hardened.

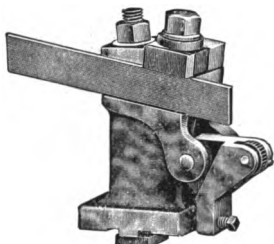
For Nos. 00 and 00G Automatic Screw Machines \$0.55

For Nos. 0 and 0G Automatic Screw Machines55

For No. 1 Automatic Screw Machine65

For Nos. 2 and 2G Automatic Screw Machines65

Combination Cutting-Off and Knurling Tool Posts



These posts are used on the back cross slide of Plain and Wire Feed Screw Machines for cross knurling and cutting-off. The knurl passes under the work and the spindle must be running forward. One blade and straight knurl are furnished.

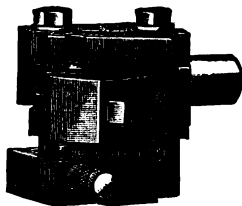
No.	No. of Machine where used	Top of Cross Slide to Centre of Spindle, Inches	Price
10	0 Wire Feed	1 9-16	\$19.50
11	1 Wire Feed	2 1-16	20.50
12	<div style="display: flex; align-items: center;"> <div style="font-size: 3em; margin-right: 10px;">{</div> <div> 2 and 2F W. F. and 2 Pl. 4 Pl. prior to 602* 5 Pl. prior to 553* </div> </div>	2 1-2	21.50

* Be sure to give serial number of machine.
For Blades see list page 323.

Angular Cutting-Off Tools

FOR AUTOMATIC SCREW MACHINES

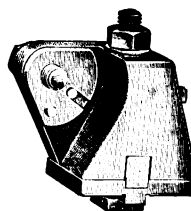
The Angular Cutting-Off Tool is held in the turret and operated by either a fixed or adjustable guide on the front cross slide. It is used when it is desired to form the end of the work cone-shaped and to produce a clean-cut sharp point when cut off. It is adjustable for any included angle within its capacity.



No.	No. of Machine where used	Total Included Angle, Degrees	Diameter of Shank, Inches	Length of Shank, Inches	Length of Body, Inches	Price
00	00, 00G & 19 Auto.	50 to 80	5-8	1 1-8	2	\$70.00
20	0 & 0G Auto.	50 to 80	3-4	1 3-8	2 5-8	97.00
22	2 & 2G Auto.	50 to 80	1	1 3-4	3 3-16	126.00

Price does not include Fixed or Adjustable Guide.

Tool Posts for Circular Tools



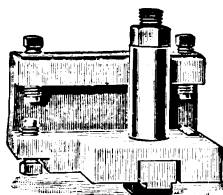
For holding circular form tools on Plain and Wire Feed Screw Machines. They are provided with tool adjustment, also a raising block so they may be used with the spindle running in either direction. In ordering, be sure to state whether to be used on front or back slide.

No.	No. of Machine where used	Maximum Diameter of Tools, Inches	Maximum Width of Tools, Inches	Top of Cross Slide to Centre of Spindle, Inches	Price each
10 Front 10 Back 11 Front 11 Back	0 Wire Feed	1 3-4	3-4	1 9-16	\$24.00
12 Front 12 Back	1 Wire Feed	2 1-4	1 1-4	2 1-16	26.00
†34 Front †34 Back †36 Front †36 Back	{ 2 & 2F W. F. & 2 Pl. { 4 Pl. prior to 602 * { 5 Pl. prior to 553 * 4 Pl. & 4 W. F. 6 Pl. & 6 W. F.	3 4 4	1 3-4 2 2 1-4	2 1-2 3 15-16 4 7-16	27.50 85.00 90.00

* Be sure to give serial number of machine.

† Has worm adjustment.

Circular Form Tool Blanks for above posts made to order.

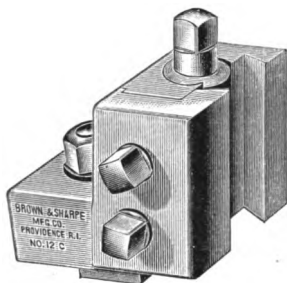


Tool Posts for Square Tools

FOR AUTOMATIC SCREW MACHINES

Means are provided for vertical adjustment of the tool. Cuts only when spindle is running one way.

No.	No. of Machine where used	Top of Cross Slide to Centre of Spindle, Inches	Size of Tools		Price each
			Height, Inches	Width, Inches	
00 Front 00 Back 20 Front 20 Back 22 Front 22 Back	00, 00G and 19 Auto.	1	5-16	7-16	\$18.00
	0 and 0G Automatic	1 5-16	1-2	5-8	23.50
	2 and 2G Automatic	1 7-16	5-8	7-8	31.50
	2 and 2G Automatic	1 7-16	5-8	1-2	31.50



Forming Tool Holders

FOR USE ON SCREW MACHINES

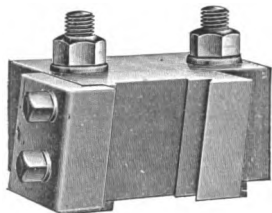
Used on the front cross slides of plain and Wire Feed Screw Machines for heavy forming cuts. The tool is adjusted vertically by means of a screw. It is clamped firmly in position after adjustment by the two cap screws on the side of the holder.

No.	No. of Machine where used	Width of Tool, Inches	Thickness of Tool, Inches	Price
10-A	0 Wire Feed	1	1-2	\$19.50
10-B	0 Wire Feed	1 1-4	1-2	19.50
11-B	1 W. F. and 1 Plain	1 1-4	9-16	24.00
11-C	1 W. F. and 1 Plain	1 3-4	9-16	24.00
12-C	{ 2 and 2F W. F. and 2 Plain } 4 Plain prior to 602*	1 3-4	3-4	27.50
12-E		2 3-4	3-4	27.50
16-D	6 Plain 8 to 230 incl.*	2 1-2	1	35.50
16-F	6 Plain 59 to 231*	4	1	35.50
34-E	4 Plain and 4 W. F.	2 3-4	1 1-4	40.00
36-F	6 Plain and 6 W. F.	4	1 1-2	45.00

* Be sure to give serial number of machine.

Forming Tool Holders

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

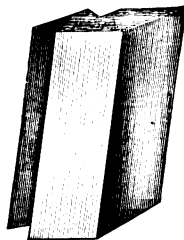


These Forming Tool Holders are held on the front cross slide of the machine and are used on heavy forming operations.

Dovetailed tool blanks for this holder are made to order.

No.	No. of Machine where used	Takes Tools, Inches	Price
24	4 Automatic	2 3-4 wide	\$37.00
26	6 Automatic	4 wide	40.00

Forming Tool Blanks



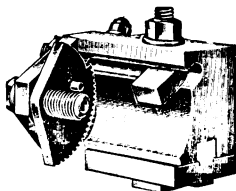
The tool blanks are dovetailed to fit the holders shown at top of opposite page, and when required have a series of slots milled in the back to receive the collar of the adjusting screw.

No.	Width, Inches	Thickness, Inches	Length, Inches	Price Carbon Steel
10-A	1	1-2	1 1-2	\$2.00
10-B	1 1-4	1-2	1 1-2	2.45
11-B	1 1-4	9-16	2	2.45
11-C	1 3-4	9-16	2	3.00
12-C	1 3-4	3-4	2 7-16	3.00
12-E	2 3-4	3-4	2 7-16	4.00
16-D	2 1-2	1	2 7-8	4.65
16-F	4	1	2 7-8	9.75
*34-E	{ 2 3-4	1 1-4	2 7-16	6.25
	{ 2 3-4	1 1-4	2 7-8	6.25
36-F	4	1 1-2	3 5-16	10.75

* Specify length wanted when ordering. For machines 3 1-2" from centre of spindle to top of cross slide use 2 7-16" length; for machines 3 15-16" centre of spindle to cross slide use 2 7-8" length.

Tool Posts with Worm Adjustment

For holding extra wide circular form tools on Automatic Screw Machines. Tool is adjusted and locked in position by worm and sector. Hook bolt for clamping tool. Raising block provides for setting tool with spindle running in either direction. Tool blanks made to order.

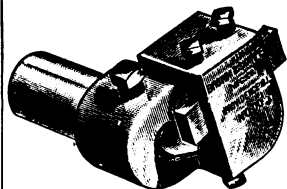


No.	Number of Machine where used	Maximum Width of Tool, Inches	Maximum Diameter of Tool, Inches	Centre of Spindle to Top of Cross Slide, Inches	Price each
20 Front	0 and 0G Auto.	1 3-4	2 1-4	1 5-16	\$58.00
22 Front	2 and 2G Auto.	2 1-4	3	1 7-16	58.00

Slotting Bushing Blanks

The Bushing Blanks are for use in the transporting arm of the various attachments for carrying the piece of work from the spindle to the attachment. The blanks are finished to fit the transporting arm, so that it is only necessary to recess to hold the piece of work and slot for the ejector. Prices, for Nos. 00 and 00G Automatic Screw Machines, \$0.45; for Nos. 0 and 0G Automatic Screw Machines, \$0.45; for Nos. 2 and 2G Automatic Screw Machines, \$0.55.

Centring and Facing Tools



The Centring and Facing Tool is used in the turret when the stock stop is dispensed with. It faces the stock to the required length and at the same time centres it to insure concentric drilling.

One blade and centring tool is furnished.

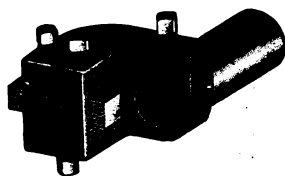
No.	No. of Machine where used	Diameter of Drill, Inches	Length of Body, Inches	Diameter of Shank, Inches	Length of Shank, Inches	Price
00	00, 00G & 19 Auto.	1-4	1 3-8	5-8	1 3-8	\$8.00
10	0 Wire Feed	5-16	1 9-16	5-8	1 7-16	9.75
11	{ 1 W. F.; 1 Pl. 0 & 0G Automatic 4 Pl. 428 to 601* }	3-8	1 11-16	3-4	2	9.75
14	{ 4 W. F. prior to 23* 5 Pl. 428 to 581* 6 Pl. 59 to 231* }	7-8	2 3-4	1 1-2	3 1-4	23.50
22	{ 2 & 2F W. F.; 2 Pl. 1, 2 & 2G Auto. }	5-8	1 3-4	1	2 3-4	16.00
34	4 Pl.; 4 W. F.	7-8	2 3-4	1 3-4	3	23.50
36	6 Pl.; 6 W. F.	1 1-4	3	2	3 1-4	30.00

* Be sure to give serial number of machine.

Knee Tools

Knee Tools are used for simultaneous turning and internal cutting. The shank is arranged to hold a drill, counterbore or similar tool clamped by set screw.

One blade is furnished.



No.	No. of Machine where used	Capacity		Diam. of Shank, Inches	Length of Shank, Inches	Length of Body, Inches	Price
		Length, Inches	Diameter up to, Inches				
00	00, 00G & 19 Auto.	1 1-4	3-8	5-8	1 1-8	1 3-8	\$16.00
20	0 & 0G Automatic	{ 2 1 3-8 3 }	{ 15-32 13-16 21-32 }	3-4	1 1-2	2 1-4	19.50
22	2 & 2G Automatic	{ 1 7-8 2 1-2 10 }	{ 1 3-8 1 1-2 1 7-8 }	1	1 3-4	3	23.50
34	4 Pl. & 4 W. F.	2 1-2	1 1-2	1 3-4	3	4 7-8	53.00
36	6 Pl. & 6 W. F.	4 5-8	2	*	*	5	40.00

* Screwed to face of turret.

Knurl Holders for Cross Slide

FOR AUTOMATIC SCREW MACHINES

Side Knurl Holders

Side Knurl Holders are used on either front or back tool posts. They are held in place in same manner as circular form tools and do not permit the use of any other tool on the same post at the same time. They are used for thread rolling on brass in addition to knurling. One straight knurl is furnished.



No.	No. of Machine where used	Diameter Holder, Inches	Width Holder, Inches	Width Knurl, Inches	Price
00A	00, 00G and 19 Auto.	1 3-4	9-16	3-16	\$6.25
20A	0 and 0G Automatic	2 1-4	5-8	1-4	8.00
21A	1 Automatic	2 1-2	11-16	1-4	8.75
22A	2 and 2G Automatic	3	11-16	1-4	9.75

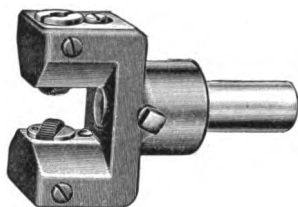
Top Knurl Holders



Top Knurl Holders are used on the rear tool post, the knurl passing over the work. They are held on a hub on the circular tool between the tool and post, both circular tool and knurl holder being clamped by one bolt. They are also used for thread rolling on brass, in which case the cutting-off tool is mounted on the same tool post. One straight knurl is furnished.

No.	No. of Machine where used	Capacity, Inches	Width Knurl, Inches	Price
00B	00, 00G and 19 Auto.	3-8	3-16	\$13.75
20B	0 and 0G Automatic	5-8	1-4	16.00
21B	1 Automatic	3-4	1-4	19.00
22B	2 and 2G Automatic	1 1-8	1-4	19.00

Adjustable Knurl Holders



FOR AUTOMATIC SCREW MACHINES

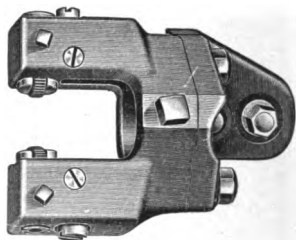
The knurls are mounted in swiveling holders adjustable to any angle to produce straight, spiral or diamond knurls, using ordinary straight knurling rolls. The knurl holders have screw adjustment for setting to any diameter of work within the capacity of the tool. The shank is arranged to take a bushing for holding end or internal cutting tools for operations to be combined with knurling. One pair of straight knurls is furnished.

No.	No. of Machine where used	Diam. of Shank, Inches	Length of Shank, Inches	Diameter will Knurl, Inches	Length will Knurl, Inches	Length of Body, Inches	Price
00	00, 00G & 19 Auto.	5-8	1 1-8	to 3-8	3-4	1 5-8	\$23.50
20	0 & 0G Auto.	3-4	1 3-4	to 9-16	1 1-2	2 3-8	23.50
22	1, 2 & 2G Auto.	1	2 3-16	{ to 15-16 to 1 1-8	{ 1 7-8 9-16	2 11-16	29.50
34	4 Pl. & 4 W. F.	1 3-4	3 1-4	{ to 1 1-16 to 1 1-2	{ 3 5-8 2	5	80.00
36	6 Pl. & 6 W. F.	2	3 1-4	{ to 1 11-16 to 2	{ 4 1-4 2 5-16	5 1-2	80.00

Adjustable Knurl Holder

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

These Adjustable Knurl Holders are similar in use to Knurl Holders described above. One pair of knurl blanks furnished.



No.	No. of Machine where used	Length will Knurl, Inches	Diam. of Hole in Body for Bushing, Inches	Price
24	4 Automatic	{ to 1 3-4 diam., 1 7-8 long or 1 5-8 diam., 3 1-2 long	1, 3-4	\$33.50
26	6 Automatic	{ to 2 diam., 2 1-4 long or 1 7-8 diam., 4 1-4 long	2	35.50

Swing Tools

FOR AUTOMATIC SCREW MACHINES

The Swing Tool is held in the turret and operated by either an adjustable or fixed guide held under the front tool post. It is used for straight, taper or irregular turning where box tools or circular form tools are not applicable, as on long, slender work of irregular shape or in turning behind shoulders. It is also used for cutting off when both cross slide tools are used for forming. The shank is arranged to hold a back rest for supporting work.



No.	No. of Machine where used	Capacity, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Length of Body, Inches	Price
		Length Diam.				
00C	00, 00G & 19 Auto.	1 1-4 to 3-8	5-8	1 5-8	15-16	\$34.00
20C	0 & 0G Auto.	2 to 15-32	3-4	1 5-8	1 7-16	35.50
		7-8 to 5-8				
20B	0 & 0G Auto.	2 to 15-32	3-4	2	1 3-4	35.50
		1 1-8 to 5-8				
22C	2 & 2G Auto.	3 to 21-32	1	2	1 7-8	38.50
		1 1-8 to 1				
22B	2 & 2G Auto.	3 to 21-32	1	2	2 17-32	42.50
		1 3-4 to 1				

Price does not include Fixed or Adjustable Guide.

Recessing Swing Tools

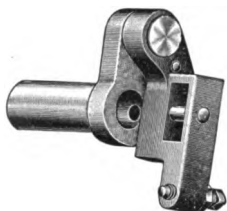
The Recessing Swing Tool is similar in design and operated in the same manner as the Swing Tool above, except it carries a round shank tool, parallel to shank of holder. It is used for chamfering and recessing internally.

No.	No. of Machine where used	Swing from Centre, Inches	Diam. of Shank, Inches	Length of Shank, Inches	Length of Body, Inches	Price
00H	00, 00G & 19 Auto.	3-16	5-8	1 3-8	15-16	\$35.50
20H	0 & 0G Automatic	1-4	3-4	1 3-4	1 1-4	38.50
22H	2 & 2G Automatic	9-32	1	2	2 1-4	42.50

Price does not include Fixed or Adjustable Guide.

Knurling Swing Tools

FOR AUTOMATIC SCREW MACHINES

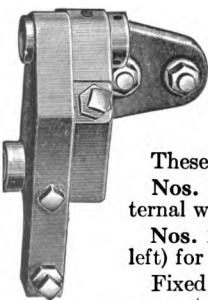


The Swing Knurl Holder is carried in the turret and is operated by either a Fixed or Adjustable Guide held under the front cross slide post. It carries a single knurl and is used for knurling behind shoulders of larger diameter or where knurled section is at some distance from the end of the piece. Also used for rolling threads on brass when the thread roll cannot be carried on the cross slide. Shank is arranged to

take a back rest for supporting the work while knurling. One straight knurl is furnished.

No.	No. of Machine where used	Capacity, Inches		Diam. of Shank, Inches	Length of Shank, Inches	Length of Body, Inches	Price
		Length	Diam. up to				
00K	00, 00G & 19 Au.	{ 1 1-4 5-8 }	{ 3-8 7-16 }	5-8	1 5-8	1 3-16	\$34.00
20K	0 & 0G Auto.	{ 2 7-8 }	{ 15-32 13-16 }	3-4	2	1 23-32	35.50
22K	2 & 2G Auto.	{ 3 1 1-4 }	{ 21-32 1 3-8 }	1	2 1-2	2 3-16	42.50

Price does not include either Fixed or Adjustable Guide. See page 335.



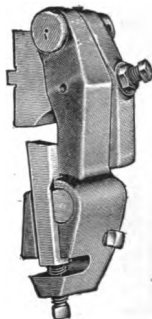
Swing Tools

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

These are used as described on preceding page.
Nos. 24 and 26 Swing Tools (at right) for external work.

Nos. 24H and 26H Recessing Swing Tools (at left) for internal work.

Fixed or Adjustable Guides for operating above are not included. See page 334.



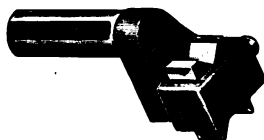
No.	No. of Machine where used	Swings from Centre, Inches	Size of Hole for Tool, Inches	Price
24 *24H	4 Automatic	{ 13-16 7-16 }	3-4 x 1 1-2	{ \$56.00 48.00 }
26 *26H		{ 7-8 1-2 }	3-4 x 1 1-2	{ 58.00 50.00 }

* Recessing Swing Tool (at left).

Back Rests for Swing Tools

FOR AUTOMATIC SCREW MACHINES

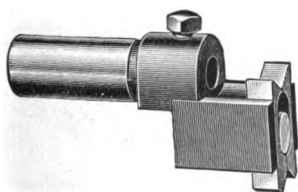
The Back Rest for Swing Tools is inserted in the hole in the shank of swing tool holders and is held in place by a set screw. The V back rests are usually set in advance of the turning tool. They are adjustable and are beveled on each end to allow for a range of diameters.



No.	No. of Machine where used	Capacity, Inches	Diameter Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00	00, 00G and 19 Auto.	1-4	7-16	1 7-16	3-4	\$9.75
20	0 and 0G Auto.	5-16	1-2	1 11-16	1	13.75
22	2 and 2G Auto.	1-2	11-16	2 1-4	1 7-16	17.75

Back Rests for Turret

FOR AUTOMATIC SCREW MACHINES



The Back Rest for Turret is clamped in any of the turret holes and used for steadying the stock to prevent springing under heavy cross slide operations, as deep forming or side knurling on a slender piece. A set screw is provided for holding a stock stop or end cutting tool in the shank. The V supports are adjustable.

No.	No. of Machine where used	Capacity, Inches	Diameter Shank, Inches	Length Shank, Inches	Length Body, Inches	Price
00	00, 00G and 19 Auto.	3-8	5-8	1 3-4	13-16	\$8.75
00A	00, 00G and 19 Auto.	3-8	5-8	1 1-8	1 1-2	9.75
20	0 and 0G Auto.	5-8	3-4	1 3-4	1 5-8	14.00
22	1, 2 and 2G Auto.	1 1-8	1	2 3-8	1 3-4	19.00

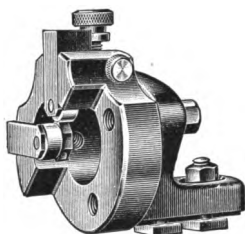
Back Rest for Chuck

This Back Rest clamps over the outside of the chuck guard on Nos. 00, 00G and 19 Automatic Screw Machines. It has a floating head carrying a bushing used for steadying small sizes of stock between the chuck and tools. Greatest distance between chuck and back rest, 1".

Price, \$29.00.

Back Rests for Turret

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES



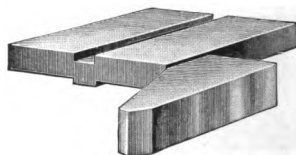
These Back Rests are of the roller type and are used for steadying the stock, to prevent springing, under cross-slide operations.

No.	No. of Machine where Used	Used on Work Diam., Inches	Price
24	4 Automatic	1-4 to 1 1-2	\$70.00
26	6 Automatic	3-8 to 1 1-2	75.00

Fixed and Adjustable Guides

FOR NOS. 4 AND 6 AUTOMATIC SCREW MACHINES

These Fixed Guides are held under the front tool post in place of the raising block ordinarily used there. They are employed for operating swing tools for forming, recessing, knurling, or thread rolling. The front face which is parallel with the axis of the spindle acts as a guide for controlling the motion of the arm of the swing tool while cutting.



No.	No. of Machine where Used	Dimensions of Guide for Controlling Swinging Arm, Inches	Price
24A	4 Automatic	5 7-8 x 15-16	\$29.00
26A	6 Automatic	6 1-2 x 15-16	29.00



Adjustable Guides are used for taper turning with swing tools. They have adjustment of guide toward or from line of spindle and swing of guide through an included angle of 30 degrees.

No.	No. of Machine where Used	Length of Guide, Inches	Price
24	4 Automatic	5	\$39.00
26	6 Automatic	6 3-8	39.00

Fixed Guides

FOR AUTOMATIC SCREW MACHINES



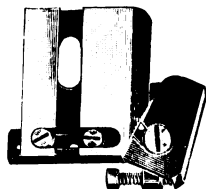
The Fixed Guide is held under the front tool post in place of the ordinary raising block used there. It is employed for operating swing tools for forming, recessing, knurling or thread rolling. The front face, which is parallel with the axis of the spindle, acts as a guide for controlling the motion of arm of the swing tool while cutting.

No.	No. of Machine where used	Length, Inches	Width, Inches	Thickness, Inches	Length Guide, Inches	Price
00A	00, 00G and 19 Auto.	2 13-16	1 3-4	1-4	1 3-8	\$8.00
20A	0 and 0G Automatic	3 15-16	2 1-2	5-16	1 3-4	9.75
22A	2 and 2G Automatic	4 13-16	3 3-8	1-2	2	13.75

Adjustable Guides

FOR AUTOMATIC SCREW MACHINES

The Adjustable Guide is held under the front tool post and is used in connection with swing and taper turning tools. The arm carrying the guide can be adjusted in and out. The guide has an angular adjustment with the line of the spindle.



No.	No. of Machine where used	Width, Inches	Thickness, Inches	Length Guide, Inches	Guide Swings through Angle	Price
00	00, 00G and 19 Auto.	2 3-8	1-4	1 5-8	30° incl.	\$9.75
20	0 and 0G Automatic	3 1-8	5-16	2 1-4	30° incl.	12.00
22	2 and 2G Automatic	3 9-16	1-2	3 1-8	30° incl.	16.00

Spindle Brakes

FOR AUTOMATIC SCREW MACHINES

The Brake consists of a wide circular metal band lined with leather, and drawn together on the open side by a clamping screw. Means are provided for attaching to the machine frame.

It is used for stopping the spindle and holding it rigidly while cross drilling, milling, etc. It is applied to one of the spindle pulleys in place of the belt, except on the No. 2G, where it clamps over one of the sprocket wheels with a shoe engaging the sprocket wheel teeth.

No.	No. of Machine where used	Width, Inches	Outside Diameter, Inches	Inside Diameter, Inches	Price
00	00 Automatic	1 1-4	4 3-8	4	\$27.50
00G	00G Automatic	1 1-4	4 3-8	4	27.50
20	0 Automatic	2	6 7-16	6	34.00
20G	0G Automatic	2	6 7-16	6	34.00
22	2 Automatic	2 1-2	7 1-2	7	36.50
22G	2G Automatic	1 3-16	4 7-8	4 11-32	36.50

Cam Templates

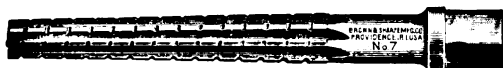
Cam Templates consist of small forms of sheet celluloid, or German silver if preferred, with numerous standard curves cut in the periphery, to be used in laying out the rise and drop on cam lobes for Automatic Screw Machines. Prices, for use with Nos. 00, 00G and 19 Automatic Screw Machines, \$3.00; Nos. 0 and 0G, \$4.00; Nos. 2 and 2G, \$4.00; No. 4 Automatic — Lead, \$18.50; Cross Slide, \$12.00; No. 6 Automatic — Lead, \$24.00; Cross Slide, \$13.00.

Lever Templates

Lever Templates are used for laying out Automatic Screw Machine cams in cases where very close timing is required, as for instance, when a tool is operated by the combined action of the cross slide and turret slide. They are made from sheet celluloid. Prices, for use with Nos. 00, 00G and 19 Automatic Screw Machines, \$4.00; Nos. 0 and 0G, \$4.00; Nos. 2 and 2G, \$4.75; No. 4 Automatic, \$12.00; No. 6 Automatic, \$13.00.

Taper Reamers

BROWN & SHARPE STANDARD



Roughing Reamer, Style 960-F



Finishing Reamer, Style 961-F

Roughing and Finishing

No. of Taper	Total Length, Inches	Length of Flutes, Inches	Price each
1	4 3-4	2 7-8	\$1.75
2	5 1-8	3 1-8	2.00
3	5 1-2	3 3-8	2.25
4	5 7-8	3 11-16	2.50
5	6 3-8	4	3.00
6	6 7-8	4 3-8	3.25
7	7 1-2	4 7-8	3.50
8	8 1-8	5 1-2	3.75
9	8 7-8	6 1-8	4.00
10	9 3-4	6 7-8	5.00
11	10 5-8	7 5-8	6.00
12	11 3-8	8 1-4	8.00
13	12	8 3-4	10.00
14	12 1-2	9 1-4	12.00
15	13 1-8	9 3-4	14.00
16	13 1-2	10 1-4	16.00
17	13 3-4	10 3-4	19.00
18	14 1-4	11 1-4	22.00

List of Standard Tapers, pages 200-201

Style 89-F

Tool Steel Taper Pins

1-4" per foot
Taper

These Taper Pins are made to meet the rapidly growing demand for a tool steel pin accurately ground to size. The small end is rounded.

In ordering special Taper Pins, give the following information: Length, Diameter at Small End and Taper per Foot.

Number	00	0	1	2	3	4	5	6	7	8	9	10
Diam. at Small End, Inches	.118	.135	.146	.162	.183	.208	.240	.279	.331	.398	.482	.581
Approx. Frac. Sizes, Inches	1-8	9-64	9-64	5-32	3-16	7-32	1-4	9-32	11-32	13-32	15-32	19-32
Length, Inches	PRICE PER HUNDRED											
11-32	....	\$1.80	....	....	....	....	....	....	....	....	....	....
7-16	....	1.80	....	....	....	....	....	....	....	....	....	....
1-2	\$1.80	1.80	....	....	....	....	....	....	....	....	....	....
9-16	1.80	1.80	....	....	....	....	....	....	....	....	....	....
5-8	1.80	1.80	....	....	....	....	....	....	....	....	....	....
11-16	1.80	1.80	....	....	....	....	....	....	....	....	....	....
3-4	1.80	1.80	\$2.00	\$2.10	\$2.30	\$2.50	\$2.75	\$3.00	....	....	....	....
13-16	1.90	1.90	2.10	2.20	2.40	2.60	2.85	3.10	....	....	....	....
7-8	1.95	1.95	2.15	2.25	2.45	2.65	2.90	3.15	....	....	....	....
15-16	2.00	2.00	2.20	2.30	2.50	2.70	2.95	3.20	....	....	....	....
1	2.05	2.05	2.25	2.35	2.55	2.75	3.00	3.25	\$3.75	....	....	....
1 1-8	....	2.10	2.35	2.45	2.65	2.85	3.10	3.35	3.85	....	....	....
1 3-16	....	2.20	2.45	2.55	2.75	2.95	3.20	3.45	3.95	....	....	....
1 1-4	....	2.30	2.50	2.60	2.80	3.00	3.25	3.50	4.00	\$4.65	....	....
1 5-16	....	2.35	2.55	2.70	2.90	3.10	3.35	3.60	4.10	4.70	....	....
1 3-8	....	2.40	2.60	2.75	2.95	3.15	3.40	3.65	4.15	4.80	....	....
1 7-16	....	2.50	2.70	2.80	3.00	3.20	3.45	3.70	4.20	4.90	....	....
1 1-2	....	2.55	2.75	2.85	3.05	3.25	3.50	3.75	4.25	5.00	\$7.00	\$9.00
1 9-16	....	....	....	2.95	3.10	3.30	3.55	3.80	4.30	5.10	7.15	9.15
1 5-8	....	....	....	3.00	3.20	3.40	3.65	3.90	4.40	5.25	7.30	9.30
1 3-4	....	....	....	3.10	3.30	3.50	3.75	4.00	4.50	5.40	7.50	9.50
1 7-8	....	....	....	3.25	3.45	3.60	3.90	4.15	4.60	5.60	7.75	9.75
2	....	....	....	3.35	3.55	3.75	4.05	4.35	4.75	5.80	8.00	10.00
2 1-8	....	....	....	....	3.70	3.90	4.20	4.55	5.00	6.00	8.30	10.35
2 1-4	....	....	....	....	3.80	4.00	4.40	4.75	5.25	6.25	8.60	10.75
2 3-8	....	....	....	....	3.95	4.15	4.60	4.95	5.50	6.50	8.90	11.10
2 1-2	....	....	....	....	4.05	4.25	4.75	5.20	5.75	6.75	9.20	11.50
2 3-4	....	....	....	....	4.30	4.50	5.10	5.70	6.25	7.25	9.80	12.25
3	....	....	....	....	4.55	4.75	5.45	6.25	6.75	7.80	10.50	13.25
3 1-4	....	....	....	....	....	....	....	6.75	7.25	8.40	11.20	14.25
3 1-2	....	....	....	....	....	....	....	....	7.75	9.00	11.90	15.25
3 3-4	....	....	....	....	....	....	....	....	8.25	9.60	12.60	16.25
4	....	....	....	....	....	....	....	....	....	10.20	13.30	17.25
4 1-4	....	....	....	....	....	....	....	....	....	10.80	14.00	18.25
4 1-2	....	....	....	....	....	....	....	....	....	11.40	14.70	19.25
4 3-4	....	....	....	....	....	....	....	....	....	....	15.40	20.25
5	....	....	....	....	....	....	....	....	....	....	16.10	21.25
5 1-4	....	....	....	....	....	....	....	....	....	....	16.80	22.25
5 1-2	....	....	....	....	....	....	....	....	....	....	....	23.25
5 3-4	....	....	....	....	....	....	....	....	....	....	....	24.25
6	....	....	....	....	....	....	....	....	....	....	....	25.25

Ground Flat Stock

This Stock is of service not only in tool work for making flat gauges, test tools, "jig work," etc., but in all work requiring steel of a definite thickness.

Stock is of first-quality tool steel, cut the length of the sheet, annealed and ground to within a limit of .001" of the given thickness.

Prices

Thickness	Size, Inches	Price per Piece	Thickness	Size, Inches	Price per Piece
1-64	2 x 18	\$1.25	5-32	1 x 18	\$0.65
	2 1-2 x 18	1.55		1 1-2 x 18	.90
	3 x 18	1.85		2 x 18	1.15
	3 1-2 x 18	2.15		2 1-2 x 18	1.40
1-32	4 x 18	2.50		3 x 18	1.70
	2 x 18	1.00		3 1-2 x 18	2.00
	2 1-2 x 18	1.25		4 x 18	2.30
	3 x 18	1.50	3-16	1 x 18	.70
1-16	3 1-2 x 18	1.75		1 1-2 x 18	1.00
	4 x 18	2.00		2 x 18	1.30
	1 x 18	.50		2 1-2 x 18	1.60
	1 1-2 x 18	.70		3 x 18	1.90
1-8	2 x 18	.90		3 1-2 x 18	2.30
	2 1-2 x 18	1.10		4 x 18	2.60
	3 x 18	1.35	7-32	1 x 18	.80
	3 1-2 x 18	1.60		1 1-2 x 18	1.15
3-32	4 x 18	1.85		2 x 18	1.50
	1 x 18	.55		2 1-2 x 18	1.85
	1 1-2 x 18	.75		3 x 18	2.20
	2 x 18	.95		3 1-2 x 18	2.60
1-4	2 1-2 x 18	1.15		4 x 18	3.00
	3 x 18	1.40	1-4	1 x 18	.90
	3 1-2 x 18	1.65		1 1-2 x 18	1.30
	4 x 18	1.90		2 x 18	1.70
1-8	1 x 18	.60		2 1-2 x 18	2.15
	1 1-2 x 18	.80		3 x 18	2.60
	2 x 18	1.00		3 1-2 x 18	3.05
	2 1-2 x 18	1.25		4 x 18	3.50
1-8	3 x 18	1.50			
	3 1-2 x 18	1.75			
	4 x 18	2.00			

Other sizes furnished to order.

Prices upon application.

Taper Mandrels and Expansion Bushings



Taper Mandrels

Mandrel No.	Whole Length, Inches	Diam. at Small End, Inches	Price	Mandrel No.	Whole Length, Inches	Diam. at Small End, Inches	Price
3	3 11-16	.3125	\$2.55	9	7 3-16	.90	\$4.70
4	4 1-16	.35	2.70	10	7 3-4	1.05	5.50
5	4 1-2	.45	3.00	11	8 3-8	1.25	6.40
6	5 1-8	.50	3.30	12	9	1.50	7.30
7	5 15-16	.60	3.60	13	9 5-8	1.75	8.60
8	6 9-16	.75	4.15	..	...	....	..

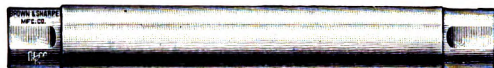
Mandrels take Bushings as follows: No. 3, 2 sizes; Nos. 4, 5, 6, 7 and 8, 3 sizes; Nos. 9, 10, 11, 12 and 13, 6 sizes.

Expansion Bushings

These Bushings are cast iron. They are intended to fit standardized holes, and are capable of expanding .005 to .007 of an inch.

Outside Diameter of Bushing, Inches	Length, Inches	For Mandrel No.	Price	Outside Diameter of Bushing, Inches	Length, Inches	For Mandrel No.	Price
1-2	1 1-2	3	\$1.00	2	4	10	\$3.70
9-16	1 5-8	3	1.00	2 1-16	4 1-8	10	3.70
5-8	1 3-4	4	1.20	2 1-8	4 1-8	10	3.70
11-16	1 7-8	4	1.20	2 3-16	4 1-4	10	3.70
3-4	2	4	1.20	2 1-4	4 1-4	10	3.70
13-16	2 1-8	5	1.50	2 5-16	4 3-8	11	4.35
7-8	2 1-4	5	1.50	2 3-8	4 3-8	11	4.35
15-16	2 3-8	5	1.50	2 7-16	4 1-2	11	4.35
1	2 1-2	6	1.75	2 1-2	4 1-2	11	4.35
1 1-16	2 5-8	6	1.75	2 9-16	4 5-8	11	4.35
1 1-8	2 3-4	6	1.75	2 5-8	4 5-8	11	4.35
1 3-16	2 7-8	7	2.10	2 11-16	4 3-4	12	5.10
1 1-4	3	7	2.10	2 3-4	4 3-4	12	5.10
1 5-16	3 1-8	7	2.10	2 13-16	4 7-8	12	5.10
1 3-8	3 1-4	8	2.55	2 7-8	4 7-8	12	5.10
1 7-16	3 3-8	8	2.55	2 15-16	5	12	5.10
1 1-2	3 1-2	8	2.55	3	5	12	5.10
1 9-16	3 5-8	9	3.15	3 1-16	5 1-8	13	5.80
1 5-8	3 5-8	9	3.15	3 1-8	5 1-8	13	5.80
1 11-16	3 3-4	9	3.15	3 3-16	5 1-4	13	5.80
1 3-4	3 3-4	9	3.15	3 1-4	5 1-4	13	5.80
1 13-16	3 7-8	9	3.15	3 5-16	5 3-8	13	5.80
1 7-8	3 7-8	9	3.15	3 3-8	5 3-8	13	5.80
1 15-16	4	10	3.70	....	....	..	....

Lathe Mandrels



These Mandrels are of tool steel, hardened and accurately ground. They are tapered .0005" to one inch.

The Mandrels from 1-4" to 1" are .0005" below size at the small end, and those from 1 1-16" to 4," .001" below size at the small end.

Diameter, Inches	Total Length, Inches	Price	Diameter, Inches	Total Length, Inches	Price
1-4	3 3-4	\$.80	1 15-16	10 3-4	\$6.00
5-16	4	.90	2	11	6.50
3-8	4 1-4	1.00	2 1-16	11 1-2	7.00
7-16	4 1-2	1.10	2 1-8	11 1-2	7.50
1-2	5	1.20	2 3-16	12	8.00
9-16	5 1-4	1.30	2 1-4	12	8.50
5-8	5 1-2	1.40	2 5-16	12	9.00
11-16	5 3-4	1.50	2 3-8	12	9.50
3-4	6	1.60	2 7-16	12 1-2	10.00
13-16	6 1-4	1.70	2 1-2	12 1-2	10.50
7-8	6 1-2	1.85	2 9-16	12 1-2	11.25
15-16	6 3-4	2.00	2 5-8	12 1-2	12.00
1	7	2.15	2 11-16	13	12.75
1 1-16	7 1-4	2.30	2 3-4	13	13.50
1 1-8	7 1-2	2.45	2 13-16	13	14.25
1 3-16	7 3-4	2.60	2 7-8	13	15.00
1 1-4	8	2.80	2 15-16	13	15.75
1 5-16	8 1-4	3.00	3	13	16.50
1 3-8	8 1-2	3.25	3 1-8	14	18.00
1 7-16	8 3-4	3.50	3 1-4	14	19.50
1 1-2	9	3.75	3 3-8	15	21.00
1 9-16	9 1-4	4.00	3 1-2	15	23.00
1 5-8	9 1-2	4.25	3 5-8	16	25.00
1 11-16	9 3-4	4.50	3 3-4	16	27.00
1 3-4	10	4.75	3 7-8	17	29.00
1 13-16	10 1-4	5.00	4	17	31.00
1 7-8	10 1-2	5.50	....	....	....

Expansion Bushings for Work Arbors

FOR AUTOMATIC GEAR CUTTING MACHINES

Outside Diameter, Inches	Number of Machine where used	Length, Inches	No. Taper Holes	Used with Arbor	Price
7-8	12	1 1-2	7	G	\$1.80
1	12	1 1-2	7	G	1.80
1 1-8	12	1 1-2	7	G	1.80
1 1-4	12	1 1-2	7	G	1.80
3-4	3, 12 and 13	3	6	E and I	2.00
7-8	3, 12 and 13	3	6	E and I	2.00
1	3, 12 and 13	3	6	E and I	2.00
1 1-8	3, 12 and 13	3	6	E and I	2.00
1 1-4	3, 12 and 13	3 1-2	9	F and J	2.55
1 3-8	3, 12 and 13	3 1-2	9	F and J	3.00
1 1-2	3, 12 and 13	3 1-2	9	F and J	3.00
1 5-8	3, 12 and 13	3 1-2	9	F and J	3.75
1 3-4	3 and 13	3 1-2	11	K	3.75
2	3 and 13	3 1-2	11	K	4.35
2 1-4	3 and 13	3 1-2	11	K	4.35
1	3H, 4 and 13H	3 1-2	7	M	2.00
1 1-8	3H, 4 and 13H	3 1-2	7	M	2.00
1 1-4	3H, 4 and 13H	3 1-2	7	M	2.55
1 3-8	3H, 4 and 13H	3 1-2	7	M	3.00
1 1-2	3H, 4 and 13H	5	10	N and P	3.00
1 5-8	3H, 4 and 13H	5	10	N and P	3.75
1 3-4	3H, 4 and 13H	5	10	N and P	3.75
2	3H, 4 and 13H	5	10	N and P	4.35
2	3H, 4 and 13H	5	12	O and T	4.35
2 1-4	3H, 4 and 13H	5	12	O and T	4.35
2 1-2	3H, 4 and 13H	5	12	O and T	5.25
2 3-4	3H, 4 and 13H	5	12	O and T	6.15
3	3H, 4 and 13H	5	12	O and T	6.90
1 1-2	5	4 1-2	10	Q	3.00
1 5-8	5	4 1-2	10	Q	3.75
1 3-4	5	4 1-2	10	Q	3.75
2	5	4 1-2	10	Q	4.35
2 1-4	5	4 1-2	10	Q	4.35
*2 1-2	5	6	13	R	5.25
*2 3-4	5	6	13	R	6.15
†*3	5	6	13	R	6.90
*3 1-4	5	6	13	R	6.90
3 1-4	5	6	14	S	6.90
*3 1-2	5	6	13	R	7.20
3 1-2	5	6	14	S	7.20
2 1-4	6	6	12	U	4.35

In ordering, state outside diameter, and letter of Arbor.

Bushings marked * can be used on Withdrawing Work Arbors furnished.

Bushings marked † are furnished with the machine.

List continued on next page.

Expansion Bushings for Work Arbors

FOR AUTOMATIC GEAR CUTTING MACHINES (*Continued*)

Outside Diam., Inches	No. of Machine where used	Length, Inches	No. Taper Holes	Used with Arbor	Price
2 1-2	6	6	12	U	\$5.25
2 3-4	6	6	12	U	6.15
*3	6	7 1-2	14	V	7.30
*3 1-4	6	7 1-2	14	V	6.75
*3 1-2	6	7 1-2	14	V	7.15
*3 3-4	6	7 1-2	14	V	8.25
†*4	6	7 1-2	14	V	8.50
4	6	9	18	W	8.90
4 1-2	6	9	18	W	9.90
5	6	9	18	W	10.90

In ordering, state outside diameter and letter of Arbor.

Bushings marked * can be used on Withdrawing Work Arbors furnished.

Bushings marked † are furnished with the machine.

Work Arbors

FOR AUTOMATIC GEAR CUTTING MACHINES



Mark	No. of Machine where used	No. of Taper of Shank	Length of Bushing, Inches	No. of Taper for Bushing	Smallest Possible Bush., Ins.	Price
†D	12	7	..	..	..	\$7.50
E	12	10	3	6	3-4	14.50
F	12	10	3 1-2	9	1 1-4	14.50
G	12	10	1 1-2	7	7-8	14.00
*I	3 and 13	10	3	6	3-4	16.00
J	3 and 13	12	3 1-2	9	1 1-4	25.50
K	3 and 13	12	3 1-2	11	1 3-4	25.50
*M	3H, 4 and 13H	11	3 1-2	7	1	18.00
†N	3H and 4	14	5	10	1 1-2	28.00
†O	3H and 4	14	5	12	2	28.00
P	13H	14	5	10	1 1-2	26.50
*Q	5	12	4 1-2	10	1 1-2	25.50
†R	5	16	6	13	2 1-2	35.50
†S	5	16	6	14	3 1-4	35.50
T	13H	14	5	12	2	26.50
†*U	6	14	6	12	2 1-4	32.00
†V	6	18	7 1-2	14	3	40.00
†W	6	18	9	18	4	43.00

Arbors marked * are for use in the Collets.

† Straight arbor; length from shoulder to nut 3", diameter 1-2".

† These arbors differ from one shown in cut in having a teat or straight end extending beyond nut and fitting into the bushing of outer support furnished with the Nos. 3H, 4, 5 and 6 machines.

Plain Vises

**FOR USE UPON
MILLING OR PLAN-
ING MACHINES**

Jaws of hardened
steel unless otherwise
specified.



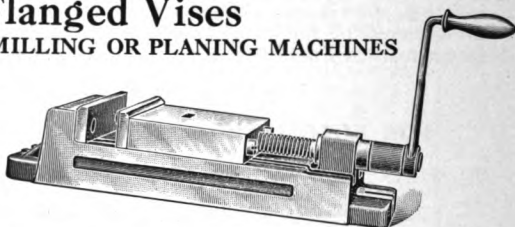
No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Weight, Lbs.	Price
1-P	4 1-8	1 1-16	2	20	\$24.00
2-P	5 1-8	1 1-4	2 3-4	30	25.00
3-P	6 1-8	1 9-16	3 5-8	55	34.00
4-P	7 1-8	2	4 1-2	95	51.00

Flanged Vises

FOR USE UPON MILLING OR PLANING MACHINES

Jaws of hardened
steel unless otherwise
specified.

These vises are pro-
vided with flanges for
clamping them to the
table of Milling or Plan-
ing Machines. Furn-
ished with bolts, nuts,
washers and clamp.



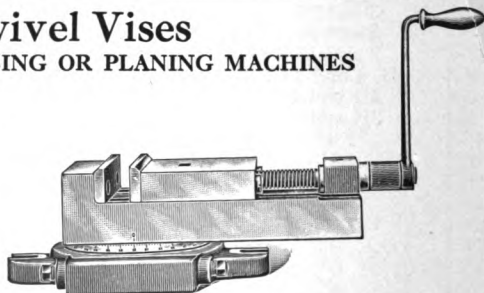
No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Weight, Lbs.	Price
1-F	4 1-8	1 1-16	2	25	\$25.00
2-F	5 1-8	1 1-4	2 3-4	35	28.00
3-F	6 1-8	1 9-16	3 5-8	65	43.00
4-F	7 1-8	2	4 1-2	110	63.00
5-F	8 5-8	2 1-2	7	200	89.00

Swivel Vises

FOR USE UPON MILLING OR PLANING MACHINES

Jaws of hardened steel
unless otherwise specified.

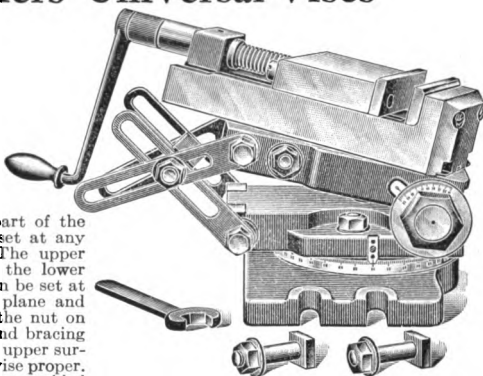
The vise is clamped to
the base by either one of
the two clamping bolts.
The vises are furnished
with tongues as follows:
No. 2-S, 5-8"; Nos. 3-S and
4-S, reversible for either
5-8" or 3-4" slots and can
be used on any table fitted
with corresponding T slots.
They are also furnished with
bolts, nuts and washers.



No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Height, Inches	Weight, Lbs.	Price
2-S	5 1-8	1 1-4	2 3-4	4 1-2	45	\$34.00
3-S	6 1-8	1 9-16	3 5-8	5 3-16	70	48.00
4-S	7 1-8	2	4 1-2	6 3-8	110	66.00

Toolmakers' Universal Vises

The base is double. The lower part is provided with a reversible tongue which can be used in a 5-8" or 3-4" T slot and is fastened to the table by two bolts, which fit into the table T slots. It has two sets of slots to allow for moving the vise back when set in a vertical plane. The upper part is a hinged knee, which swivels on the lower part of the base. The lower part of the knee is graduated and can be set at any angle in a horizontal plane. The upper part of the knee is hinged to the lower part in such a manner that it can be set at any angle to 90° in a vertical plane and clamped rigidly in position by the nut on end of bolt forming the hinge and bracing levers shown at left of cut. The upper surface is graduated for setting the vise proper. The bolt forming the hinge is provided with a hardened steel dial graduated to 90°. The bracing levers are held in position by the bolt shown in centre and the bolts at the ends of the levers.



The vise proper swivels on the upper part of the hinged knee, can be set at any angle to the axis of the bolt forming the hinge and clamped in position by the bolt which holds the upper bracing lever.

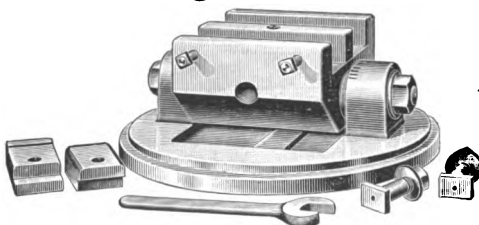
The jaws are made of tool steel, hardened. Each vise is furnished with a wrench.

Dimensions of boxes in which vises are shipped: No. 2-T, 17" x 12" x 9"; No. 3-T, 21" x 14" x 11".

No.	Width of Jaws, Inches	Depth of Jaws, Inches	Jaws Open, Inches	Net Weight, Lbs.	Shipping Weight, Lbs.	Price
2-T	5 1-8	1 1-4	2 3-4	65	80	\$83.00
3-T	6 1-8	1 9-16	3 5-8	135	160	110.00

Adjustable Swivel Vise

Adapted for use on Planing and Surface Grinding Machines



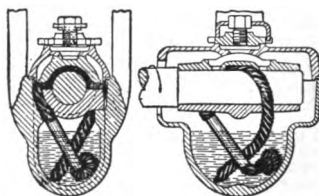
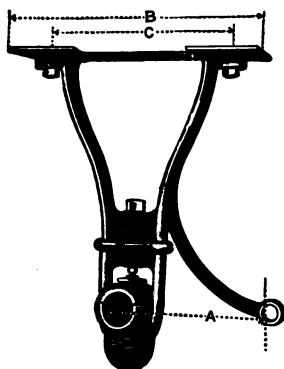
This Vise can be set at any angle with the T slots of the table and is pivoted so that it can be set at any angle to 40 degrees either side of the horizontal, the position being indicated by a graduated arc. Bolts, nuts, washers and clamps are furnished. Height of vise, 4".

The jaws are 5" wide, 1" deep, and will open 2 3-4".

Weights. Net, about 30 lbs.; ready for shipment, about 40 lbs. Dimensions for shipment, 13" x 12" x 6".

Price, \$38.00

Self-Oiling Hangers



FILL WITH GOOD OIL

The above cut represents a Hanger which is provided with a receptacle for oil for the purpose of lubricating the bearings, the oil being fed to the same by capillary attraction. This hanger is made with or without arms and with one end of the drip closed or both ends open.

No. 1

Takes Boxes 1' x 4' or 1 1-4' x 4 1-2'

Drop, Inches	Distance from Centre of Shaft to Shipper Rod A, Inches	Extreme Width B, Inches	Distance between Centres of Bolt Holes C, Inches	Diameter of Holes, Inches	Single Hanger	Pair of Hangers
10	No arm	16	12 1-8	3-4	\$4.75	...
10	7 9-16	16	12 1-8	3-4	5.00	\$10.00
10	8 5-16	16	12 1-8	3-4	5.00	10.00
12	No arm	16	12 1-8	3-4	4.75	...
12	7 9-16	16	12 1-8	3-4	5.00	10.00
12	8 5-16	16	12 1-8	3-4	5.00	10.00
12	9 7-16	16	12 1-8	3-4	5.00	10.00
12	10 9-16	16	12 1-8	3-4	5.00	10.00
16	No arm	16	12 1-8	3-4	5.00	...
16	7 9-16	16	12 1-8	3-4	5.25	10.50
16	8 5-16	16	12 1-8	3-4	5.25	10.50
16	9 7-16	16	12 1-8	3-4	5.25	10.50
17	No arm	16	12 1-8	3-4	5.00	...
18	No arm	16	12 1-8	3-4	5.00	...

Self-Oiling Hangers

No. 2

Takes Boxes 1 1-2' x 6' or 1 5-8' x 6 1-2'

Drop, Inches	Distance from Centre of Shaft to Shipper Rod A, Inches	Extreme Width B, Inches	Distance between Centres of Bolt Holes C, Inches	Diameter of Holes, Inches	Single Hangers	Pair of Hangers
12	No arm	16	12 1-8	7-8	\$7.00	.....
12	9 7-16	16	12 1-8	7-8	7.25	\$14.50
12	11 5-16	16	12 1-8	7-8	7.25	14.50
12	9 7-16 and 11 7-16	16	12 1-8	7-8	7.25	14.50
12	11 5-16 and 13 1-16	16	12 1-8	7-8	7.25	14.50
16	No arm	16	12 1-8	7-8	7.25	.....
16	9 7-16	16	12 1-8	7-8	7.50	15.00
16	11 1-16	16	12 1-8	7-8	7.50	15.00
16	11 1-16 and 13 1-16	16	12 1-8	7-8	7.50	15.00

No. 3

Takes Boxes 1 11-16' x 6 1-2', 1 15-16' x 7' or 2 3-16' x 7 1-2'

12	10 13-16	19	15	1 1-8	\$14.50	\$29.00
12	10 13-16 and 12 13-16	19	15	1 1-8	14.50	29.00
14	12 13-16	19	15	1 1-8	15.00	30.00
14	12 13-16 and 14 13-16	19	15	1 1-8	15.00	30.00

*No. 5

Takes Boxes 2' x 8', 2 3-16' x 9' or 2 7-16' x 10'

16	No arm	22	18	1 1-8	\$21.00	.....
16	12 9-16	22	18	1 1-8	21.50	\$43.00
16	12 9-16 and 14 9-16	22	18	1 1-8	21.50	43.00

Two shipper rod stops and one shipper dog accompany each pair of hangers with arms. When hangers and friction pulleys are ordered together, we will send a shipper fork for operating the thimble. When hangers and tight and loose pulleys are ordered together, we will send belt guides.

* Differs slightly from one shown in cut.

Counter-Shafts

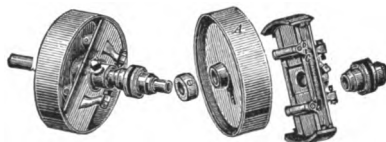
WITH FRICTION PULLEYS, HANGERS AND BOXES

Price includes shaft, one pair of Patent Self-Oiling Friction Pulleys, page 348, Hangers with self-oiling boxes, page 346, shipper rod, forks and stops and stud for attaching shipper handle.

With Friction Pulleys, Diameter, Inches	Length of Shaft in Clear between Hangers, Inches	Diameter of Shaft, Inches	Diameter of Bearing, Inches	Price
8	26	1 1-4	1	\$35.00
10	33	1 1-4	1	41.00
12	33	1 1-2	1 1-4	45.00
14	33	1 1-2	1 1-4	49.00
16	44	1 11-16	1 1-2	65.00
18	44	1 11-16	1 1-2	75.00

Self-Oiling Friction Pulleys

PAD TYPE



We have in our works a large number of these pulleys. They are simple in construction and noiseless when in use. Friction is applied in the most effective manner, as the pads act directly on the rims of the pulleys which are bronze bushed. The centre oil pocket is an important feature. All the parts are easily adjusted to compensate for wear.

Each pair of pulleys has one thimble and two collars; each single pulley has one thimble and one collar.

When ordering two or more pulleys, state if same are to be used singly or in pairs.

Diameter, Inches	Belt, Inches	Hole, Inches	Price per Pair	Price each
8	2 1-4	1 1-4	\$20.00	\$11.00
10	3	1 1-4	25.00	13.50
12	3 1-2	1 1-2	29.00	15.50
14	3 1-2	1 1-2 or 1 11-16	34.00	18.00
16	4	1 11-16	44.00	23.00
18	4 1-2	1 11-16	54.00	28.00

Space on Shaft required to operate Friction Pulleys

Diameter of Pulley, Inches	Single Pulley, Inches	Pair of Pulleys, Inches
8	10	16 1-4
10	12 3-8	20
12	14	23
14	14	23 1-4
16	15	25
18	15 1-2	26

Highest speed at which these Pulleys can satisfactorily be run.

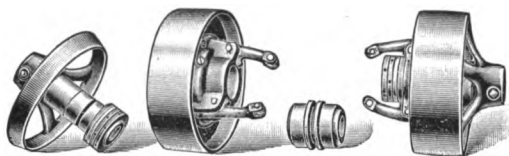
8" — 450 revolutions per minute.	14" — 275 revolutions per minute.
10" — 375 revolutions per minute.	16" — 250 revolutions per minute.
12" — 325 revolutions per minute.	18" — 225 revolutions per minute.

Pulleys with special holes furnished when desired.

Price, single pulley, \$3.50 extra. Two or more pulleys, \$3.00 each, extra.

Self-Oiling Friction Pulleys

CONE TYPE



These pulleys are designed for high speed and hard service. The pulley runs on the hub of the inner friction surface and is provided with a ring oiler, which amply lubricates the bearing when the pulley is running idle.

Each pair of pulleys and each single pulley is furnished with one thimble.

When ordering two or more pulleys, state if same are to be used singly or in pairs.

Diameter, Inches	Belt, Inches	Size of Hole, Inches	Weight, lbs.	Price Single Pulley	Price per Pair
8	2 1-2	1 1-4 or 1 1-2	23	\$15.50	\$29.00
10	3	1 1-2 or 1 11-16	37	18.50	35.00
12	3 1-2	1 1-2, 1 11-16 or 1 15-16	59	23.00	44.00
14	4	1 11-16 or 1 15-16	74	29.00	56.00
16	4 1-2	1 11-16, 1 15-16 or 2 3-16	93	35.00	68.00
18	6	2 3-16	172	75.00	148.00

Space on Shaft required to operate Friction Pulleys

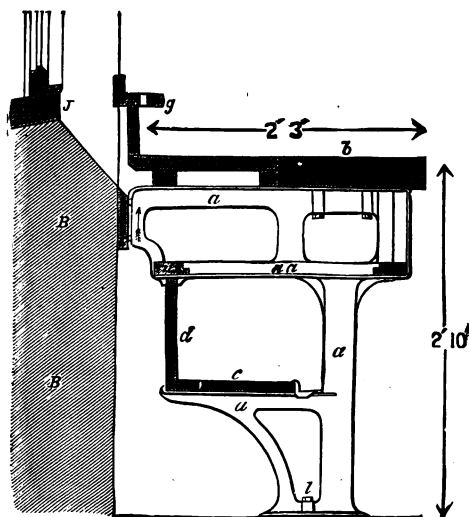
Diameter, Inches	Single Pulley, Inches	Two Pulleys, Inches	Three Pulleys, Inches
8	11 1-8	19	36 1-8
10	10 3-4	18 1-2	35 3-8
12	12 1-2	22	40 1-4
14	14 1-4	24 3-4	46 1-2
16	16 1-2	28 3-4	53 3-4
18	20 1-2	36 7-8	...

Pulleys with special holes furnished when desired.

Price, single pulley, \$3.50 extra. Two or more pulleys, \$3.00 each extra.

It is often desirable to run the spindle of a machine at different speeds in the same direction; for this purpose we make a special pulley with long levers and a special thimble. Three pulleys can thus be operated with one shipper rod.

Improved Work Bench



The above cut shows an improved design of Bench for iron and wood work. The leg or casting *a* consists of a rigid standard, a bracket for the support of the shelf *c*, and its accompanying back. The legs or standards are fastened to the floor by coach screws, shown at *l*, and are supported at the back by the wall *B B*. They are usually placed about 4 feet apart and support the bench *b*, the shelf *g*, the framework *n*, and the shelf *c*, with its accompanying back. The framework *n* forms a strong support upon which the drawers slide. The shelf *c* supported by the brackets is held in place by the cast-iron clip, shown at the front. The shelf *g* affords a neat and substantial support for electric light or gas brackets. The front of the leg or standard is provided with a hole to receive the bolt for holding the vise and this construction brings the vise directly over the leg or standard.

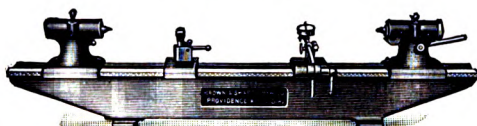
We are prepared to furnish these bench leg castings complete, drilled and ready for use. For the support of a bench at a corner the design of the casting varies slightly from that shown above and the use of castings for this purpose should be specified. We can also furnish complete sets of pattern castings for iron work of above described bench.

Drawings, showing instructions, sent with orders.

Bench Leg Castings	Price, each	\$8.25
Corner Leg Castings	Price, each	9.75
Pattern Castings	Price, each	30.00

Improved Bench Centres

8" x 36"



Price, with Indicator, \$140.00 Without Indicator, \$105.00

These Centres swing 8" in diameter and take 36" in length.

The head- and foot-stock spindles are of steel, ground and accurately fitted. The foot-stock centre is held firmly in contact with the work by a stiff spring and, as the spindle is quickly operated by a lever, work can be easily placed in position and removed. Provision is made for clamping the foot-stock spindle when desired.

Dial Test Indicator

The sleeve that holds the arm can be clamped at any height on the post or turned around to bring the arm on either side. The arm turns in the sleeve and may be set at any angle relative to the base. All parts are detachable.

The movement of the contact point that bears upon the work is magnified a number of times and indicated by the pointer on a dial. The dial reads to thousandths of an inch and can be adjusted to allow the setting of the zero graduation to any required position.

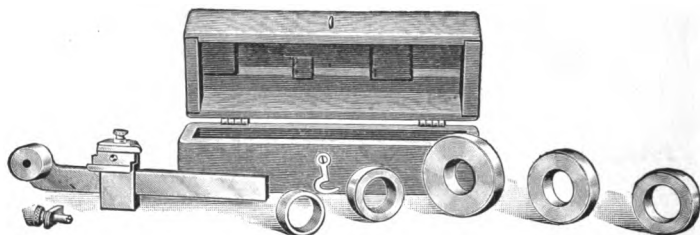
The dial can also be furnished to read to hundredths of a millimetre.

A Work Support is furnished.

All the parts are movable on the bed and are clamped in position by screws provided with fixed handles, thus dispensing with wrenches.

Weights. Net, about 150 lbs.; ready for shipment, about 215 lbs. Dimensions for shipment, 55" x 12" x 14". Space occupied, about 5 cubic feet.

Cutter Clearance Gauge

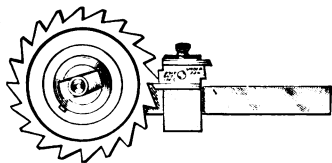


Price, \$50.00

This gauge is designed for the purpose of aiding the operator in grinding the correct angle of clearance on milling cutters. It consists of a hardened steel bar $6\frac{1}{2}$ " long, to one end of which is attached a hardened stud $\frac{7}{8}$ " in diameter for holding the cutters. A set of five bushings is provided for the stud so that cutters having holes $\frac{7}{8}$ ", 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ " and 2" may be tested. The bushing is held in place on the stud by a spring stop.

The gauge is mounted on a slide which is easily moved along the bar.

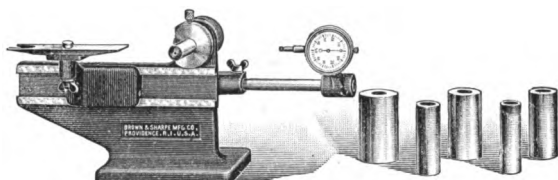
It is attached to the side of the slide by a pin which allows it to be revolved, one end being used for cutters under 3" in diameter, the other end for cutters 3" in diameter and over.



To test for correct clearance, the cutter is placed on the stud with proper bushing, and the gauge pushed forward. The cutter is then revolved sufficiently to bring the face of a tooth in contact with the stop on the gauge which gives the correct position for the cutter. The angle of clearance on the tooth should then correspond to the angle of the gauge. Cutters of any width may be tested with the gauge.

The gauge and bushings are packed in a finished wooden box, as shown above.

Cutter Testing Fixture



Price, \$75.00

Without Indicator, \$59.00

Gear and formed cutters are designed in such a manner that the faces of the teeth must be ground radially and all teeth must be of even height whenever they are sharpened. This fixture is designed especially for detecting the slightest inaccuracies in grinding. All sizes of cutters up to 10" in diameter can be accommodated.

A cutter is tested by bringing the face of each tooth to bear upon a hardened-steel plate whose top surface is radial with the stud upon which the cutter is supported; all points of the cutting contour should simultaneously touch the surface of the testing plate. At the same time the dial indicator shows whether the teeth are all of the same height.

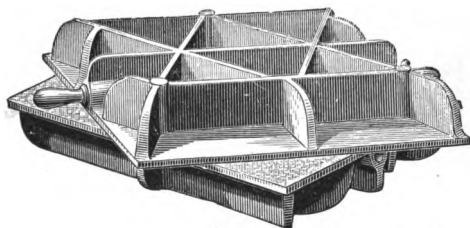
The testing plate is reversible and is attached by a bolt and thumb nut to a slide that moves in horizontal ways cut in the side of the fixture body. By this arrangement the plate can be readily inserted to test a tooth and withdrawn to permit the following tooth to be brought into position. A taper gib on the slide provides means of taking up the wear and keeping the surface of the testing plate correctly lined.

The stud upon which the cutters are supported is made of hardened steel, $\frac{5}{8}$ " diameter. It has a taper shank which fits into a taper steel sleeve that is fastened securely in the fixture body.

The dial indicator reads to thousandths of an inch. The fixture can also be furnished with a metric dial reading to hundredths of a millimetre.

Equipment: Five bushings, hardened and ground, $\frac{7}{8}$ ", 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ " and $1\frac{3}{4}$ " diameter, and a collar for use when testing thin cutters.

Standard Cast Iron Surface Plates



We have in stock a variety of sizes, to which we frequently make additions, all of which are uniform in style.

These plates are usually sold singly, not in pairs, as shown in cut. Prices quoted are for single plate with cover.

Size, Inches	Approximate Weight, Lbs.	Price Each	Size, Inches	Approximate Weight, Lbs.	Price Each
3 1-2 x 4	2	\$5.25	12 x 18	58	\$45.00
3 1-2 x 12	10	12.00	12 x 24	92	62.50
4 x 7	6	9.50	12 x 36	158	90.00
4 x 15	17	16.50	*12 x 144	2000	510.00
4 x 18	18	17.50	*12 x 65	390	180.00
*4 x 40	80	37.50	14 x 14	52	38.50
4 1-2 x 6	5	9.25	14 x 18	58	50.00
5 x 16	18	18.50	14 x 21	78	62.50
6 x 6	6	11.50	15 x 30	160	95.00
6 x 12	15	17.50	16 x 16	66	50.00
6 x 26	46	31.00	16 x 48	355	174.00
6 x 50	105	65.00	18 x 18	90	65.00
*6 x 72	280	108.00	18 x 24	120	88.00
6 1-2 x 18	30	26.50	18 x 36	180	115.00
7 x 7 1-2	10	14.50	20 x 30	200	126.00
7 x 10	15	17.50	24 x 24	205	119.00
8 x 12	19	20.00	24 x 36	285	182.00
9 x 9	16	18.50	24 x 48	485	245.00
9 x 14	29	24.50	24 x 60	696	317.00
10 x 15	39	30.00	30 x 36	375	228.00
10 x 30	86	63.50	30 x 60	800	394.00
10 x 50	190	105.00	36 x 68	1355	557.00
*11 x 84	800	240.00	....	....	....
12 x 12	30	28.50	....	....	....

* Made to order only.

Cast Iron Straight Edges



These Straight Edges are of a form best adapted to retain a straight line.

The edge of each is scraped to form a true surface, and the straight edges when thus made are indispensable in the proper scraping of the ways of planer and lathe beds, etc.

Size, Inches	Weight, Lbs.	Price
18 x 1 1-2	5	\$18.00
24 x 1 5-8	10	24.00
30 x 1 3-4	15	30.00
36 x 1 7-8	15	34.00
48 x 2	35	40.00
60 x 2 1-8	50	52.00
72 x 2 1-4	75	64.00
84 x 2 5-16	120	78.00
96 x 2 3-8	145	94.00
120 x 2 3-4	300	120.00
*144 x 3	420	....
*180 x 3 1-2	835	....

Price includes cover.

*Made to order only. Prices upon application.

Cast Iron Packing Boxes

FOR USE IN CASE-HARDENING AND ANNEALING FURNACES

Dimensions are all inside measurements.

In ordering, please give pattern numbers.

Rectangular Boxes

Pattern No.	Length, Inches	Width, Inches	Depth, Inches	Weight, Lbs.	Price	Dumping Fork, Inches
1	3 3-4	1 7-8	2	2	\$0.45	...
2	3 1-4	3 1-4	3 1-2	7	1.05	...
3	4	4	5 1-2	12	1.50	5 1-2
4	5 1-8	5 1-8	6	15	1.90	*6 1-8
5	6 7-8	6 1-8	5 1-2	22	2.80	7 1-2
6	6 7-8	6 1-8	7 1-2	26	3.30	7 1-2
7	7 3-8	5 1-4	9	38	4.40	*6 1-2
8	7 1-2	2 5-8	7 3-4	29	3.65	4
9	7 1-2	3 1-8	9 1-2	25	3.15	*5 1-4
10	9 3-4	3 3-8	3	14	1.75	*4 5-8
11	10 1-4	4 5-8	3 1-2	15	1.90	5 1-2
12	11 1-4	4 5-8	5 1-4	22	2.80	5 1-2
13	11 3-4	6 1-8	5 1-2	31	3.90	7 1-2
14	11 3-4	6	6 1-4	40	4.60	7 1-2
16	10 3-4	10 3-4	9	89	10.25	...
17	13 3-4	4 5-8	4	24	3.00	5 1-2
18	13	9 3-4	7 7-8	95	11.00	...
19	15 1-8	13 5-8	9 3-4	198	19.60	...
20	18	9 1-2	9 1-2	101	10.00	...
21	20	9	7 3-4	109	10.80	...
22	28	9	8	132	13.10	...
23	20 3-4	10 3-4	14 5-8	253	25.00	...
24	20	14	20 1-4	461	45.70	...
25	38	9 1-2	8	179	17.75	...
26	14	6 1-4	6	51	5.90	7 1-2
30	7	6 1-4	6 5-8	21	2.65	7 1-2
37	8	4 3-4	10 1-2	39	4.50	5 1-2

List continued on next page.

* Made to order.

Cast Iron Packing Boxes (Continued)**Rectangular Boxes (Continued)**

Pattern No.	Length, Inches	Width, Inches	Depth, Inches	Weight, Lbs.	Price	Dumping Fork, Inches
*41	22 1-2	12 1-8	15	220	\$21.80	...
*43	25	14	24	436	43.20	...
44	11 3-4	6 1-8	7 1-2	41	4.75	7 1-2
45	20	11	10	140	13.90	...
46	18	4 1-2	6 1-2	70	8.10	...
*47	25	4 3-4	9	112	11.10	...
48	11 7-8	5 7-8	9 1-2	55	6.35	7 1-2
*50	12	6 1-4	6 1-2	35	4.45	7 1-2
*52	26	10 1-4	22 1-2	400	39.60	...
53	8	3	6 3-4	15	1.90	4

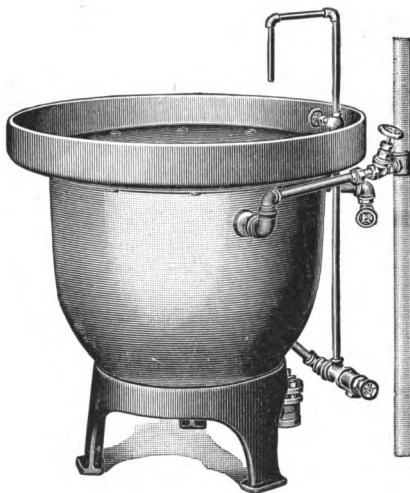
* Made to order.

Round Boxes

Pattern No.	Diameter, Inches	Depth, Inches	Weight, Lbs.	Price
23	6	6	20	\$2.55
24	3 1-8	2 1-8	3	.65
27	11 3-8	8	58	6.70
29	15 3-4	8	81	9.35
31	7	7 1-2	33	4.15
32	12 1-4	8	82	9.45
34	19 1-2	8 3-8	148	14.60
36	9	6	46	5.30
37	11 3-4	13	123	12.20
*40	2 5-8	2	5	.75
45	14	8	100	9.90
46	13 3-4	14	158	15.65
47	7 3-4	9	45	5.20
48	9 1-2	12	85	9.80
50	13	14	126	12.50
53	24	9	251	24.90
58	14 3-4	14 3-4	224	22.20
60	8	10 1-2	53	6.10
61	7	9	40	4.60

* Made to order.

Soda Kettle



This Kettle is used for cleaning or removing grease and dirt from small tools and parts of machines. A coil of steam pipe is employed to heat the water, in which a quantity of soda has been placed, and the pieces immersed in the solution when taken out dry without rusting.

The kettles are usually made with round tops and stand in the centre of the room among the machines, but they are also made of a form suitable to place against a wall or in a corner.

Outside diameter of top plate, 38"; diameter of kettle, 29"; diameter of inside coil of pipe, 24"; height from floor to top of flange, 37"; depth of kettle, 22"; diameter of wire basket or cage for receiving the work, 11"; depth of basket, 16". Capacity of kettle, about 60 gallons.

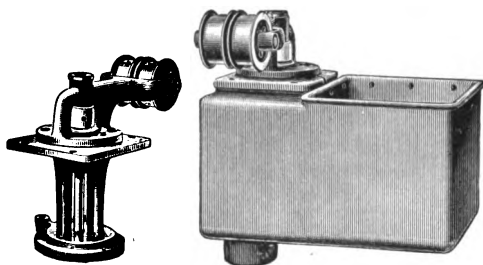
A perforated bucket or shaker, 6 $\frac{1}{4}$ " diameter, 13" long, is furnished for convenience in washing small pieces.

Weights. Net, about 600 lbs.; ready for shipment, about 800 lbs. Dimensions for shipment, 40" x 40" x 40". Space occupied, about 36 cubic feet.

Equipment. Interior coil of pipe, wire basket, perforated bucket or shaker and the pipe with valves, etc., as shown in cut.

Price, \$169.00.

Centrifugal Water Pumps



No.	Height Forced	4 feet	8 feet	12 feet	16 feet	20 feet	Discharge, Inches	Net Weight, Lbs.
	Rev. per Minute	Capacity, Quarts per Minute						
2	800	7	3-8	40
	1000	13	6	..	..	..
	1500	24	20	14	5	..		
4	500	8	3-4	85
	750	24	16	..	..	..
	1200	96	53	40	28	16		

Minimum speed at which No. 2 Pump should run to raise water 4 feet, 800 rpm.; No. 4, 500 rpm.

Driving pulley, No. 2 Pump, 2" diameter for 1" belt; No. 4 Pump, 2 3-4" diameter for 1 1-4" belt.

These pumps are for use with water only and, as the bearings do not come in contact with the water, are well adapted for use on grinding or other machines where the water used contains a large amount of emery particles or grit.

The pump consists of a simple fan revolving in a case. The fan revolves in a horizontal plane and is immersed in the water. By this method the pump is constantly primed and there is no leak from loose packings.

The driving belt, which makes a quarter turn around the idle pulleys, furnished with the pump, can run over the counter-shaft or can run over pulleys connected with some part of the machine.

The bracket, which supports the idle pulleys, is held by two bolts that slide in slots, thus allowing the pulleys to be set in any desired position.

Prices. No. 2 Pump, \$20.00; No. 4 Pump, \$38.00.

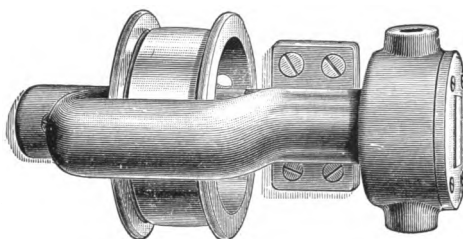
Tanks for Nos. 2 and 4 Pumps

Tanks especially designed for use with these pumps, provided with a settling pan and plug to draw off the water, can be furnished when desired.

For No. 2. Price, \$15.00. Weight, 67 lbs. Cap. 6 gals.

For No. 4. Price, 54.00. Weight, 165 lbs. Cap. 21 gals.

No. 8 Oil Pump



Used in supplying oil to the cutting tools of metal-working machines, as screw machines, lathes, bolt cutters, etc. It changes automatically to pump when running in either direction. By placing the stops on the eccentric ring to the right or left of the pins in the case, either side of the pump may be used for the suction.

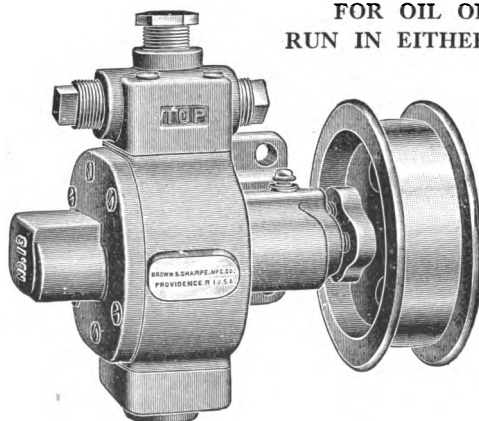
Price, \$9.00. Without pulley, \$7.75.

Revolutions per Minute	Capacity, Qts. per Minute	Height Forced, Ft.	Suction, Inches	Discharge, Inches	Weight, Lbs.
100	1	12	1-4	1-4	8 1-2
300	1-2	16	1-4	1-4	
500	2	20	1-4	1-4	
	4	20	1-4	1-4	

Driving Pulley, 3 1-2" diameter for 1" belt.

Nos. 11, 12 and 13 Geared Pumps

FOR OIL OR WATER
RUN IN EITHER DIRECTION



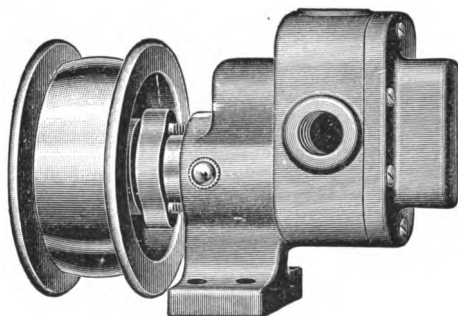
For use on machines, where the cutting tools operate in more than one direction, as on screw machines and machines that reverse. Simple in construction, the principal mechanism being a pair of gears which run together in a tight case.

Price	Without Pulley
No. 11, \$13.75	\$12.75
No. 12, 17.75	16.50
No. 13, 24.00	22.50

No.	Revolutions per Minute	Capacity, Qts. per Min.	Height Forced, Ft.	Suction, Inches	Discharge, Inches	Weight, Lbs.
11	300	4	20	3-8	1-4 or 3-8	10
	500	8	20			
12	300	12	20	1-2	3-8 or 1-2	15
	500	24	20			
13	300	20	20	3-4	1-2 or 3-4	30
	500	40	20			

Driving Pulley, No. 11, 3 1-2" diameter for 1" belt; No. 12, 4 1-4" diameter for 1" belt; No. 13, 5" diameter for 1 1-4" belt.

Nos. 1, 2 and 3 Geared Pumps FOR OIL OR WATER



No.	Revolutions per Minute	Capacity, Quarts per Minute	Height Forced, Feet	Suction, Inches	Discharge, Inches	Weight, Pounds
1	300 500	4 8	20 20	3-8	1-4 or 3-8	8
2	300 500	12 24	20 20	1-2	3-8 or 1-2	14
3	300 500	20 40	20 20	3-4	1-2 or 3-4	24

Driving Pulley for No. 1, 3 1-2" diameter for 1" belt.

Driving Pulley for No. 2, 4 1-4" diameter for 1" belt.

Driving Pulley for No. 3, 5" diameter for 1 1-4" belt.

These Pumps are principally used on machines where the cutting tools operate in only one direction, as Milling Machines, Gear Cutting Machines, Chucking Machines, etc., but, by running the pumps independently, they can be used on machines that reverse. They are simple in construction, the principal mechanism being a pair of gears which run together in a tight case.

To obtain the best results the pump should be placed as near as possible to the level of the liquid in the tank.

Price, No. 1, \$11.00. Without pulley, \$10.00.

Price, No. 2, \$13.50. Without pulley, \$12.25.

Price, No. 3, \$16.00. Without pulley, \$14.50.

Nos. 21 and 23 Bronze Circulating Pumps

These pumps differ from Nos. 1, 2 and 3 only in being made entirely of bronze. The No. 23 has 25 per cent nickel steel shafts. Bronze shafts will be furnished if specified.

Price, No. 21, \$15.00. Without pulley, \$14.00. Weight, complete, 7 lbs.

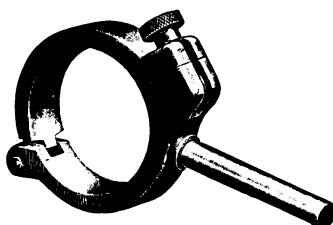
Price, No. 23, \$35.00. Without pulley, \$33.50. Weight, complete, 20 lbs.

Pump Accessories

FOR MILLING MACHINES



Distributer



Distributer Bracket



Distributer Swivel



Check Valve



Relief Valve



Valve

Distributer

For Nos. 1 and 11 Pumps, Pipe Size 1-2"	\$3.50
For Nos. 2 and 12 Pumps, Pipe Size 3-4"	4.00
For Nos. 3 and 13 Pumps, Pipe Size 1"	4.75

Distributer Bracket

For 2 3-4" Overhanging Arm	\$4.75
For 3 1-2" Overhanging Arm	6.00
For 4 1-4" Overhanging Arm	6.25
For 4 1-2" Overhanging Arm	6.50
For 4 3-4" Overhanging Arm	7.00
For 5" Overhanging Arm	7.50

Distributer Swivel

For Use with 1-2" Distributer	\$2.75
For Use with 3-4" Distributer	2.75
For Use with 1" Distributer	3.50

Valve

For Use with 1-2" Distributer, Pipe Size 1-2"	\$6.50
For Use with 3-4" Distributer, Pipe Size 3-4"	7.50
For Use with 1" Distributer, Pipe Size 1"	9.00

Check Valve

3-8" for Nos. 1 and 11 Pumps	\$1.00
1-2" for Nos. 2 and 12 Pumps	1.10
3-4" for Nos. 3 and 13 Pumps	1.25

Relief Valve

1-4" for Nos. 1, 8 and 11 Pumps	\$1.60
3-8" for Nos. 1 and 11 Pumps	2.20
1-2" for Nos. 2, 3, 12 and 13 Pumps	2.50

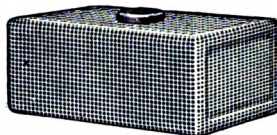
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Pump Accessories (*Continued*)

FOR MILLING MACHINES



Flexible Tube Swivel for Base
Flexible Tube Swivel for Table



Strainer

Flexible Tube Swivel for Base Flexible Tube Swivel for Table *

Used with Nos. 1 and 11 Geared Pumps, Pipe Size 3-4" \$2.50

Used with Nos. 2 and 12 Geared Pumps, Pipe Size 1" 4.00

*45° for Universal Milling Machines; 90° for Plain Milling Machines. In ordering flexible tube swivels give style, size and serial number of machine, also state whether swivel is for base or table.

Strainer

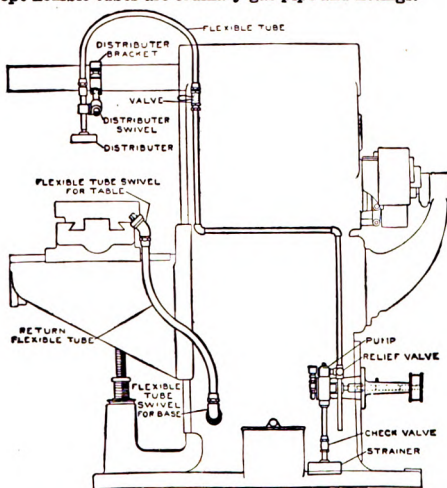
For No. 8 Oil Pump, Pipe Size 1-4" \$1.25

For Nos. 1 and 11 Geared Pumps, Pipe Size 3-8" 1.70

For Nos. 2 and 12 Geared Pumps, Pipe Size 1-2" 2.00

For Nos. 3 and 13 Geared Pumps, Pipe Size 3-4" 2.50

Other parts except flexible tubes are ordinary gas pipe and fittings.



Arrangement of Oil Piping for Milling Machines.

Weights

Of Square and Round Bars of Wrought Iron

IN POUNDS PER LINEAR FOOT. — *Kent*

Iron weighing 480 lbs. per cubic foot

For Steel add 2 per cent

Thickness or Diameter, Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diameter, Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
0	.....	.....	2 1-2	20.83	16.36
1-16	.013	.010	9-16	21.89	17.19
1-8	.052	.041	5-8	22.97	18.04
3-16	.117	.092	11-16	24.08	18.91
1-4	.208	.164	3-4	25.21	19.80
5-16	.326	.256	13-16	26.37	20.71
3-8	.469	.368	7-8	27.55	21.64
7-16	.638	.501	15-16	28.76	22.59
1-2	.833	.654	3	30.00	23.56
9-16	1.055	.828	1-16	31.26	24.55
5-8	1.302	1.023	1-8	32.55	25.57
11-16	1.576	1.237	3-16	33.87	26.60
3-4	1.875	1.473	1-4	35.21	27.65
13-16	2.201	1.728	5-16	36.58	28.73
7-8	2.552	2.004	3-8	37.97	29.82
15-16	2.930	2.301	7-16	39.39	30.94
1	3.333	2.618	1-2	40.83	32.07
1-16	3.763	2.955	9-16	42.30	33.23
1-8	4.219	3.313	5-8	43.80	34.40
3-16	4.701	3.692	11-16	45.33	35.60
1-4	5.208	4.091	3-4	46.88	36.82
5-16	5.742	4.510	13-16	48.45	38.05
3-8	6.302	4.950	7-8	50.05	39.31
7-16	6.888	5.410	15-16	51.68	40.59
1-2	7.500	5.890	4	53.33	41.89
9-16	8.138	6.392	1-16	55.01	43.21
5-8	8.802	6.913	1-8	56.72	44.55
11-16	9.492	7.455	3-16	58.45	45.91
3-4	10.21	8.018	1-4	60.21	47.29
13-16	10.95	8.601	5-16	61.99	48.69
7-8	11.72	9.204	3-8	63.80	50.11
15-16	12.51	9.828	7-16	65.64	51.55
2	13.33	10.47	1-2	67.50	53.01
1-16	14.18	11.14	9-16	69.39	54.50
1-8	15.05	11.82	5-8	71.30	56.00
3-16	15.95	12.53	11-16	73.24	57.52
1-4	16.88	13.25	3-4	75.21	59.07
5-16	17.83	14.00	13-16	77.20	60.63
3-8	18.80	14.77	7-8	79.22	62.22
7-16	19.80	15.55	15-16	81.26	63.82

Continued on next page.

Weights

Of Square and Round Bars of Wrought Iron

IN POUNDS PER LINEAR FOOT.—*Kent*

Iron weighing 480 lbs. per cubic foot

For Steel add 2 per cent

Thickness or Diameter, Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diameter, Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
5	83.33	65.45	7	163.3	128.3
1-16	85.43	67.10	1-8	169.2	132.9
1-8	87.55	68.76	1-4	175.2	137.6
3-16	89.70	70.45	3-8	181.3	142.4
1-4	91.88	72.16	1-2	187.5	147.3
5-16	94.08	73.89	5-8	193.8	152.2
3-8	96.30	75.64	3-4	200.2	157.2
7-16	98.55	77.40	7-8	206.7	162.4
1-2	100.8	79.19	8	213.3	167.6
9-16	103.1	81.00	1-4	226.9	178.2
5-8	105.5	82.83	1-2	240.8	189.2
11-16	107.8	84.69	3-4	255.2	200.4
3-4	110.2	86.56	9	270.0	212.1
13-16	112.6	88.45	1-4	285.2	224.0
7-8	115.1	90.36	1-2	300.8	236.3
15-16	117.5	92.29	3-4	316.9	248.9
6	120.0	94.25	10	333.3	261.8
1-8	125.1	98.22	1-4	350.2	275.1
1-4	130.2	102.3	1-2	367.5	288.6
3-8	135.5	106.4	3-4	385.2	302.5
1-2	140.8	110.6	11	403.3	316.8
5-8	146.3	114.9	1-4	421.9	331.3
3-4	151.9	119.3	1-2	440.8	346.2
7-8	157.6	123.7	3-4	460.2	361.4
....	....	....	12	480.0	377.0

To compute the weight of Sheet Iron:

Multiply the thickness by 40; the result is the weight in pounds per square foot.

Example: A piece of Sheet Iron is .005" thick, its weight is $.005 \times 40 = .200$ lbs. per square foot.

To compute the weight of Sheet Steel:

Multiply the thickness by 40.8; the result is the weight in pounds per square foot.

Example: A piece of Sheet Steel is .005" thick, its weight is $.005 \times 40.8 = .204$ lbs. per square foot.

Weight of Iron and Steel Sheets

WEIGHT PER SQUARE FOOT.—*Kent*

Thickness by Birmingham Gauge				Thickness by American (Brown & Sharpe's) Gauge			
No. of Gauge	Thickness, Inches	Iron	Steel	No. of Gauge	Thickness, Inches	Iron	Steel
0000	.454	18.16	18.52	0000	.46	18.40	18.77
000	.425	17.00	17.34	000	.4096	16.38	16.71
00	.38	15.20	15.30	00	.3648	14.59	14.88
0	.34	13.60	13.87	0	.3249	13.00	13.26
1	.3	12.00	12.24	1	.2893	11.57	11.80
2	.284	11.36	11.59	2	.2576	10.30	10.51
3	.259	10.36	10.57	3	.2294	9.18	9.36
4	.238	9.52	9.71	4	.2043	8.17	8.34
5	.22	8.80	8.98	5	.1819	7.28	7.42
6	.203	8.12	8.28	6	.1620	6.48	6.61
7	.18	7.20	7.34	7	.1443	5.77	5.89
8	.165	6.60	6.73	8	.1285	5.14	5.24
9	.148	5.92	6.04	9	.1144	4.58	4.67
10	.134	5.36	5.47	10	.1019	4.08	4.16
11	.12	4.80	4.90	11	.0907	3.63	3.70
12	.109	4.36	4.45	12	.0808	3.23	3.30
13	.095	3.80	3.88	13	.0720	2.88	2.94
14	.083	3.32	3.39	14	.0641	2.56	2.62
15	.072	2.88	2.94	15	.0571	2.28	2.33
16	.065	2.60	2.65	16	.0508	2.03	2.07
17	.058	2.32	2.37	17	.0453	1.81	1.85
18	.049	1.96	2.00	18	.0403	1.61	1.64
19	.042	1.68	1.71	19	.0359	1.44	1.46
20	.035	1.40	1.43	20	.0320	1.28	1.31
21	.032	1.28	1.31	21	.0285	1.14	1.16
22	.028	1.12	1.14	22	.0253	1.01	1.03
23	.025	1.00	1.02	23	.0226	.904	.922
24	.022	.88	.898	24	.0201	.804	.820
25	.02	.80	.816	25	.0179	.716	.730
26	.018	.72	.734	26	.0159	.636	.649
27	.016	.64	.653	27	.0142	.568	.579
28	.014	.56	.571	28	.0126	.504	.514
29	.013	.52	.530	29	.0113	.452	.461
30	.012	.48	.490	30	.0100	.400	.408
31	.01	.40	.408	31	.0089	.356	.363
32	.009	.36	.367	32	.0080	.320	.326
33	.008	.32	.326	33	.0071	.284	.290
34	.007	.28	.286	34	.0063	.252	.257
35	.005	.20	.204	35	.0056	.224	.228

Specific gravity Iron 7.7 Steel 7.854

Weight per cubic foot " 480. " 489.6

Weight per cubic inch " .2778 .2833

As there are many gauges in use differing from each other and even the thicknesses of a certain specified gauge, as the Birmingham, are not assumed the same by all manufacturers, orders for sheets and wires should always state the weight per square foot or the thickness in thousandths of an inch.

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